RED HAWK FIRE PROTECTION, LLC

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City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

REDHAHF901QP

Ever Vigilant®

MATERIAL SUBMITTALS

FOR

Wesley Bradley Park – Phase 2
Puyallup, WA

RHFP JOB NO. 70120

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RED HAWK FIRE PROTECTION

Material Notes:
Any material with the comment "Or Equal" indicates cut sheet represents an exact or similar product to what will be installed. These products generally are generic in nature and due to vender availability, price changes, or other unknowns, a similar product my be selected. All products used will meet all NFPA 13, authority having jurisdiction, and project specifications requirements.

Section 1 - Pipe & Fittings

Description	***Make***	***Model***	***Comments***
CPVC Piping System	Spears	FlameGuard Line	Covers Entire Line
Black Steel Sprinkler Pipe - Schedule 10 & 40	Bull Moose	N/A	Or Equal
Stainless Steel Pipe - Schedule 10 & 40	ASC - SCI	N/A	Or Equal
Weld On Outlets for Steel Pipe	ASC - Anvil	N/A	Or Equal
Threaded Fittings - Ductile Iron	ASC - Anvil	N/A	Or Equal
Grooved Rigid Coupling	Victaulic	Style 009N	
Grooved Flexible Coupling	Victaulic	Style 004N	
Grooved Reducing Coupling	Victaulic	Style 750	
Grooved Flange Adaptor	Victaulic	Style 744	
Grooved Fittings - 1¼"-1½"	Victaulic	Varies	Standard Pattern
Grooved Fittings - 2" & Larger	Victaulic	Varies	Short Pattern
Grooved End of Run Fitting	Victaulic	No. 67	
Grooved Drain Cap	GemLock	F155D	

Section 2 - Hangers & Attachments

Description	***Make***	***Model***	***Comments***
CPVC - Double Offset	Eaton - Tolco	Fig. 29	1" and 1¼" only
CPVC - Stand-Off Hanger (No-Block)	ASC - Anvil	Fig. 188R	Or Equal
CPVC - Side Mount Hanger	ASC - Anvil	Fig. 187	Or Equal
All Thread Rod - Plated	ASC - Anvil	N/A	Or Equal
Rod Coupling	ASC - FPPI	05-135, 05-137	Or Equal
Loop/Ring Hanger - Standard Duty	nVent - CADDY	115	Or Equal
Riser Clamp	nVent - CADDY	510 EZ	Or Equal
Concrete Anchor - Mini-Undercut	HILTI	HDI-P TZ	3/8"
Concrete Inserts - PT Deck	HILTI	KCC-WF	

Section 3 - Bracing & Restraints

Description	***Make***	***Model***	***Comments***
Ring Hanger - Surge Restraint	Eaton - Tolco	Fig. 25	For CPVC Installed on Ring Hangers
Concrete Anchor - Screw	HILTI	KH-EZ	Sized per Seismic Calculations
Concrete Anchor - Wedge	HILTI	Kwik Bolt TZ2	Sized per Seismic Calculations
Brace Structure Attachment - Generic (EQ Ear)	nVent - CADDY	CSBU	Sized per Seismic Calculations
Brace Pipe Attachment - Longitudinal and Lateral Brace	nVent - CADDY	CSB	
Brace Pipe Attachment - Lateral Brace	nVent - CADDY	CSBQG EG	
Branch Line Restraint - Pipe Attachment	nVent - CADDY	CSBBRP	
Branch Line Restraint - Structure Attachment	nVent - CADDY	CSBBRS	

Section 4 - Valves & Accessories

Description	***Make***	***Model***	***Comments***
Ball Valve	Argco	600#	Or Equal
Butterfly Valve, with Tamper	Lansdale	LVBG1 (S-1)	
Check Valve - Grooved	Lansdale	LVCVGG	
Backflow - Grooved Double Check	Watts - Ames	Deringer 20	
Angled Hose Valve	Lansdale	LHV	Groove X FNPT
Angled Hose Valve - Brass Cap & Chain	Lansdale	LVCNC	Or Equal
Riser Manifold, With Butterfly & Check	Victaulic	Series UMC	Floor Controls
Test & Drain Valve, With Pressure Relief	Victaulic	UTD	Equipped on UM & UMC Manifolds
Flexible Drain Hose	Reliable	Streamline	
Dry Pipe Valve	Tyco	DPV-1	Standard in Dry Systems
Dry Pipe Accelerator - Standard Pressure Pneumatic	Tyco	ACC-1	Use with the Tyco DPV-1 Only
Air Compressor - Tank Mounted	C-AIRE	S715 - LD	
Air Maintaince Device	General Air	AMD-1	

Section 5 - Alarms & Supervisory Devices

Description	***Make***	***Model***	***Comments***
Air Pressure Gauge	Wika Instrument LP	111.10SP	Or Equal
Water Flow Switch	Potter Signal	VSR	
Pressure Switch, Alarm	Potter Signal	PS10	
Pressure Switch, High/Low Supervisory	Potter Signal	PS40	Standard Pressure Dry Pipe System
Supervisory Switch, OS&Y Style	Potter Signal	OSYSU	
Alarm Bell - 24v, 10"	Lansdale	LVBBB	Provided Upon Request

Section 6 - Fire Sprinklers

Description	***Make***	***Model***	***Comments***
Residential - Pendent, Concealed	Tyco	LFII (4.9K)	Reference Plans for Details
Standard Spray - Pendent, Concealed	Tyco	RFII (5.6K)	Reference Plans for Details
Standard Spray - Upright, Quick Response (QR)	Tyco	TY-FRB (5.6K)	Reference Plans for Details
Standard Spray - Dry Sprinkler (Pendent, Upright, & Sidewall), QR	Reliable	F3QR56 (5.6K)	Reference Plans for Details
Extended Coverage - Corridor Pendent, Concealed	Tyco	RFII-C (5.6K)	Reference Plans for Details
Extended Coverage - Upright, Pendent, Light & Ordinary Hazard	Tyco	EC-11 (11.2K)	Reference Plans for Details
Special Application Upright - Attic Sprinklers, Varied Locations	Victualic	FL/SA (5.6 K)	Reference Plans for Details

Section 7 – Miscellaneous

Description	***Make***	***Model***	***Comments***
Teflon Tape	Argco	PTFE Tape Industrial	
Pipe Dope	Argco	Tuf-Glide	
Thread Oil	ASC - FPPI	Threadfit Clear Oil	
Coupling Gasket Grease	ASC - FPPI	LubeFit	
CPVC Glue	Spears	FS-5 One Step Cement	
Fire Caulk for Fire Rated Penetrations	HILTI	FS-One	
Fire Rated Sleeves	HILTI	CP 680-P	
Sprinkler Spare Stock Box	Argco	6510150	
Sprinkler Escutcheons & Coverplates - Standard	Tyco/Reliable	Varies	

SECTION 1

Pipe & Fittings

Submittal Information for Spears® Manufacturing Company FlameGuard ® CPVC Fire Sprinkler System

GSFG-0221

Date: ______________________

Job Name: ________________________________ **Location:** _________________________________

Engineer: _________________________________ **Contractor:** _______________________________

Scope:

This submittal covers the Spears® FlameGuard® CPVC Fire Sprinkler System suitable for residential and light hazard occupancies in accordance with The National Fire Protection Association (NFPA). The FlameGuard® System shall be sold as a complete system which consists of pipe, fittings and a specially formulated one-step primerless cement intended for use in wet, dry and pre-action systems in residential and light hazard Applications where the operating temperature/pressure does not exceed 175psi @ 150° F. (1.2 MPa @ 66° C)

Product Specification:

All CPVC fire sprinkler fittings and pipe shall be Spears® FlameGuard®. All solvent cement shall be Spears® FS-5 One-Step, and all thread sealant shall be Spears® Blue 75™ as produced by Spears® Manufacturing Company.

All Spears® FlameGuard® CPVC fire sprinkler fittings shall be manufactured in the U.S.A. from a Chlorinated Polyvinyl Chloride (CPVC) compound having a minimum cell classification of 23447 in accordance with ASTM D1784. Fittings shall be manufactured in strict compliance to ASTM F438 or F439, as applicable. All CPVC fire sprinkler piping shall be manufactured in the U.S.A. from a Chlorinated Polyvinyl Chloride (CPVC) compound having a minimum cell classification of 23447 in accordance with ASTM D1784. Piping shall be manufactured in strict compliance to ASTM F442. All CPVC solvent cement shall be a primerless, one-step type manufactured in strict compliance to ASTM F493 and approved for use with CPVC fire sprinkler systems. All CPVC fire sprinkler fittings, pipe and solvent cement shall be listed by Underwriters Laboratories (UL®), Underwriters Laboratories Canada (ULC®) and/or Factory Mutual Research Corporation (FM Global) and/or LPCB for use in residential and light hazard wet, dry and pre-action systems and bear their authorized certification marks. Thread sealant shall be approved by the fitting manufacturer for use with CPVC fire sprinkler products. All CPVC fittings, pipe, solvent cement and thread sealant shall be certified by NSF International as applicable. Pipe and solvent cement shall be certified to UL 2818 GREENGUARD GOLD.

Product Marking:

FlameGuard® system components shall be orange in color for identification and include required markings and approvals prescribed in ASTM F442 for pipe and ASTM F438 or F439 for fittings. Pipe and cement shall have GREENGUARD GOLD marking.

Installation:

Spears® FlameGuard® CPVC Fire Sprinkler System shall carry a working pressure of 175 psi @ 150F (1.2 MPa @ 66° C) and shall be installed in accordance with Spears® Manufacturing Company FlameGuard® CPVC Fire Sprinkler Products Installation Instructions (FG-3) and Addendums. National Fire Protection Association (NFPA) Standards 13, 13D, and 13R must be referenced for design and installation requirements in conjunction with the Installation Instructions and applicable local codes. Installation practices such as pipe support spacing, bracing, allowance for thermal expansion/contraction, solvent cementing and handling and storage shall be in accordance with the manufacturer's instructions and this specification. Buried pipe shall be in accordance with NFPA 24 for supply mains. The piping system shall be joined using a chemically resistant one-step primerless solvent cement joining process conforming to ASTM F493. The system shall be protected from ultra violet (UV) light exposure from the sun or other source and protected from any chemicals that are not compatible with the CPVC materials including but not limited to fire stopping materials, plasticizers, incompatible thread sealants, etc.

NOTE: FlameGuard® CPVC piping systems can be leak tested using oil-free compressed air up to 25psi but must also be hydrostatically tested as required per NPFA standard.

Referenced Standards:

ASTM D1784 – Rigid Vinyl Compounds
ASTM F438 – CPVC Schedule 40 Fittings
ASTM F439 – CPVC Schedule 80 Fittings
ASTM F442 – CPVC SDR Pipe
ASTM F493 – Solvent Cements for CPVC Pipe & Fittings
NFPA 13, 13D, 13R – National Fire Protection Association Standards
NFPA 24 – Installation – Private Fire Service Mains
NSF International Standard 14/61 – Potable Water

Approvals:

NSF® – NSF International Standard 14/61 – Potable Water
Underwriters Laboratories – Listing Agency
FM Global –Listing Agency
UL-GREENGUARD GOLD Certified UL 2818
LPCB – Loss Prevention Council Board

BULL MOOSE TUBE

SCHEDULE 10, 30, & 40 SPRINKLER PIPE SUBMITTAL DATA SHEET

APPROVALS AND SPECIFICATIONS

- ASTM A135, Grade A
- ASTM A795, Type E, Grade A
- Pressure rated to 300 psi
- Underwriters Laboratories—United States of America
- Underwriters Laboratories—Canada
- Factory Mutual
- NFPA-13
- NFPA-13R
- NFPA-14
- CIVIL DEFENSE APPROVAL—United Arab Emirates
- Made in the United States of America
- UL, ULC & FM listed for roll-groove, plain-end and welded joints for wet, dry, preaction and deluge sprinkler systems.
- LEED v4 Certified

FINISHES AND COATINGS

- Schedule 10, 30 & 40 Sprinkler Pipe receives an OD mill coating of water-based paint which has corrosion protection expected with a painted carbon steel product, i.e. it would be expected to resist corrosion for an extended and indefinite period in a clean and dry environment and, as environmental conditions deteriorate, the corrosion protection would also diminish.
- Schedule 10, 30 & 40 Sprinkler Pipe (black) receives an ID mill coating of Eddy Guard II MIC preventative coating. EG2 has been tested at independent laboratories to resist bacterial growth and maintain minimal bacterial count after multiple flushes (25) of the pipe.
- Schedule 10, 30 & 40 Sprinkler Pipe when Hot Dip Galvanized by ASTM A123 and supplied by Bull Moose Tube is UL listed and FM approved.

PRODUCT IDENTIFICATION

- Every length of Bull Moose fire sprinkler pipe features large, easy-to-read, continuous stenciling, clearly identifying the manufacturer, type of pipe, size, and length.

	Nominal Pipe Size (inches)	1	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	6"	8"†	10"
Schedule 10	O.D. (in)	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	8.625	10.750
	I.D. (in)	1.097	1.422	1.682	2.157	2.635	3.260	4.260	6.357	8.249	10.374
	Empty Weight (lb/ft)	1.41	1.81	2.09	2.64	3.53	4.34	5.62	9.29	16.94	21.23
	Water Filled Weight (lb/ft)	1.800	2.518	3.053	4.223	5.893	7.957	11.796	23.038	40.086	57.874
	C.R.R.*	15.270	9.910	7.760	6.270	4.920	3.540	2.500	1.158	1.805	2.410
	Pieces per Lift	91	61	61	37	30	19	19	10	7	7
Schedule 40 & 30†	O.D. (in)	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	8.625	
	I.D. (in)	1.049	1.380	1.610	2.067	2.469	3.068	4.026	6.065	8.071	
	Empty Weight (lb/ft)	1.68	2.27	2.72	3.66	5.8	7.58	10.8	18.99	24.72	
	Water Filled Weight (lb/ft)	2.055	2.918	3.602	5.114	7.875	10.783	16.316	31.498	50.240	
	C.R.R.*	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	Pieces per Lift	70	51	44	30	30	19	19	10	7	

*Calculated using Standard UL CRR formula, UL Fire Protection Directory, Category VIZY

SUBMITTAL INFORMATION

Project

Contractor

Engineer

Specification Reference

Date

System Type

Locations

Comments

- Schedule 10 - Black
- Schedule 10 - Hot Dip Galvanized
- Schedule 30 - Black
- Schedule 30 - Hot Dip Galvanized
- Schedule 40 - Black
- Schedule 40 - Hot Dip Galvanized

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SCI®
QUALITY PLUS

Pipe and Tubing

Pipe Specifications

- Welded and seamless pipe material conforms to ASTM A312, ASTM A999
- Stainless pipe dimensions conform to ASTM A999, ASME B36.19, ASME B36.10, A276
- Manufacturing facility is ISO 9001:2008
- Pipe sold as single random lengths
- Cut-to-length, threading and grooving available upon request

Instrumentation Tubing Specifications

- Instrumentation tubing dimensions and materials conform to ASTM A269 and ASTM A213

Sanitary Tubing Specifications

- Sanitary tubing dimensions and materials conform to ASTM A269, ASTM A270 and 3-A Approved

Stainless Pipe - Welded Sch 10 & Sch 40

Fig. S6014WP & S6016WP - Sch 10 Welded Pipe

Diameter in	Part Number		OD in	Wall Thickness in	Pipe Length ft	Weight lb / ft
	304 / 304L	316 / 316L				
1/2	S6014WP004	S6016WP004	0.84	0.083	20	0.6
3/4	S6014WP006	S6016WP006	1.05	0.083	20	0.8
1	S6014WP010	S6016WP010	1.32	0.109	20	1.4
1-1/4	S6014WP012	S6016WP012	1.66	0.109	20	1.8
1-1/2	S6014WP014	S6016WP014	1.90	0.109	20	2.0
2	S6014WP020	S6016WP020	2.37	0.109	20	2.6
2-1/2	S6014WP024	S6016WP024	2.87	0.120	20	3.5
3	S6014WP030	S6016WP030	3.50	0.120	20	4.3
4	S6014WP040	S6016WP040	4.50	0.120	20	5.6
5	S6014WP050	S6016WP050	5.563	0.134	20	7.7
6	S6014WP060	S6016WP060	6.625	0.134	20	9.2

Fig. S6044WP & S6046WP - Sch 40 Welded Pipe

Diameter in	Part Number		OD in	Wall Thickness in	Pipe Length ft	Weight lb / ft
	304 / 304L	316 / 316L				
1/8	S6044WP001	S6046WP001	0.41	0.068	20	0.2
1/4	S6044WP002	S6046WP002	0.54	0.088	20	0.4
3/8	S6044WP003	S6046WP003	0.67	0.091	20	0.5
1/2	S6044WP004	S6046WP004	0.84	0.109	20	0.8
3/4	S6044WP006	S6046WP006	1.05	0.113	20	1.1
1	S6044WP010	S6046WP010	1.32	0.133	20	1.6
1-1/4	S6044WP012	S6046WP012	1.66	0.140	20	2.2
1-1/2	S6044WP014	S6046WP014	1.90	0.145	20	2.7
2	S6044WP020	S6046WP020	2.37	0.154	20	3.6
2-1/2	S6044WP024	S6046WP024	2.87	0.203	20	5.7
3	S6044WP030	S6046WP030	3.50	0.216	20	7.5
4	S6044WP040	S6046WP040	4.50	0.237	20	10.7
5	S6044WP050	S6046WP050	5.563	0.258	20	14.6
6	S6044WP060	S6046WP060	6.625	0.280	20	18.9

Fig. S6144SP & S6146SP - Sch 40 Seamless Pipe

Diameter in	Part Number		OD in	Wall Thickness in	Pipe Length ft	Weight lb / ft
	304 / 304L	316 / 316L				
1/8	S6144SP001	S6146SP001	0.41	0.068	20	0.2
1/4	S6144SP002	S6146SP002	0.54	0.088	20	0.4
3/8	S6144SP003	S6146SP003	0.67	0.091	20	0.5
1/2	S6144SP004	S6146SP004	0.84	0.109	20	0.8
3/4	S6144SP006	S6146SP006	1.05	0.113	20	1.1
1	S6144SP010	S6146SP010	1.32	0.133	20	1.6
1-1/4	S6144SP012	S6146SP012	1.66	0.140	20	2.2
1-1/2	S6144SP014	S6146SP014	1.90	0.145	20	2.7
2	S6144SP020	S6146SP020	2.37	0.154	20	3.6

Fig. S6184SP & S6186SP - Sch 80 Seamless Pipe

Diameter in	Part Number		OD in	Wall Thickness in	Pipe Length ft	Weight lb / ft
	304 / 304L	316 / 316L				
1/8	S6184SP001	S6186SP001	0.41	0.095	20	0.3
1/4	S6184SP002	S6186SP002	0.54	0.119	20	0.5
3/8	S6184SP003	S6186SP003	0.67	0.126	20	0.7
1/2	S6184SP004	S6186SP004	0.84	0.147	20	1.0
3/4	S6184SP006	S6186SP006	1.05	0.154	20	1.4
1	S6184SP010	S6186SP010	1.32	0.179	20	2.1
1-1/4	S6184SP012	S6186SP012	1.66	0.191	20	2.9
1-1/2	S6184SP014	S6186SP014	1.90	0.200	20	3.6
2	S6184SP020	S6186SP020	2.37	0.218	20	5.0

*Fig. 96BP4 Schedule 40 Seamless Brass Pipe**

Size in	Part Number 20 ft Length	OD in	Wall Thickness in	Pipe Length ft	Weight / Foot lb
1/8	96BP4001200	0.41	0.068	20	0.3
1/4	96BP4002200	0.54	0.088	20	0.4
3/8	96BP4003200	0.67	0.091	20	0.6
1/2	96BP4004200	0.84	0.109	20	0.9
3/4	96BP4006200	1.05	0.113	20	1.3
1	96BP4010200	1.32	0.133	20	1.8
1-/4	96BP4012200	1.66	0.140	20	2.6
1-1/2	96BP4014200	1.90	0.145	20	3.1
2	96BP4020200	2.37	0.154	20	4.1
2-1/2	96BP4024200	2.87	0.203	20	6.0
3	96BP4030200	3.50	0.216	20	8.7
4	96BP4040200	4.50	0.237	20	12.7

Fig. S64ST4 & S64ST6 – Seamless Instrumentation Tubing

Tube OD	Wall Thickness	Part Number		ID	Tube Length	Weight
in	in	304/L	316/L	in	ft	lb / ft
1/8	0.035	S64ST4035001	S64ST6035001	0.055	20	0.03
1/8	0.049	S64ST4049001	S64ST6049001	0.027	20	0.04
1/4	0.028	S64ST4028002	S64ST6028002	0.194	20	0.06
1/4	0.035	S64ST4035002	S64ST6035002	0.180	20	0.08
1/4	0.049	S64ST4049002	S64ST6049002	0.152	20	0.1
1/4	0.065	S64ST4065002	S64ST6065002	0.120	20	0.1
1/4	0.083	S64ST4083002	S64ST6083002	0.084	20	0.1
5/16	0.035	S64ST4035516	S64ST6035516	0.243	20	0.1
3/8	0.035	S64ST4035003	S64ST6035003	0.305	20	0.1
3/8	0.049	S64ST4049003	S64ST6049003	0.277	20	0.1
3/8	0.065	S64ST4065003	S64ST6065003	0.245	20	0.2
3/8	0.083	S64ST4083003	S64ST6083003	0.209	20	0.2
1/2	0.035	S64ST4035004	S64ST6035004	0.430	20	0.1
1/2	0.049	S64ST4049004	S64ST6049004	0.402	20	0.2
1/2	0.065	S64ST4065004	S64ST6065004	0.370	20	0.3
1/2	0.083	S64ST4083004	S64ST6083004	0.334	20	0.4
1/2	0.120	S64ST4120004	S64ST6120004	0.260	20	0.5
5/8	0.035	S64ST4035005	S64ST6035005	0.555	20	0.2
5/8	0.049	S64ST4049005	S64ST6049005	0.527	20	0.3
5/8	0.065	S64ST4065005	S64ST6065005	0.495	20	0.3
5/8	0.083	S64ST4083005	S64ST6083005	0.509	20	0.5
3/4	0.035	S64ST4035006	S64ST6035006	0.680	20	0.2
3/4	0.049	S64ST4049006	S64ST6049006	0.652	20	0.3
3/4	0.065	S64ST4065006	S64ST6065006	0.620	20	0.4
3/4	0.083	S64ST4083006	S64ST6083006	0.584	20	0.6
3/4	0.095	S64ST4095006	S64ST6095006	0.560	20	0.7
1	0.035	S64ST4035010	S64ST6035010	0.930	20	0.3
1	0.049	S64ST4049010	S64ST6049010	0.902	20	0.4
1	0.065	S64ST4065010	S64ST6065010	0.870	20	0.6
1	0.083	S64ST4083010	S64ST6083010	0.834	20	0.8
1	0.095	S64ST4095010	S64ST6095010	0.810	20	0.9
1	0.120	S64ST4120010	S64ST6120010	0.760	20	1.1
1-1/4	0.065	S64ST4065012	S64ST6065012	1.120	20	0.8

Fig. S62TP4 & S62TP6 – Sanitary Tubing

Tube OD	Part Number		Wall Thickness	I.D.	Tube Length	Weight
in	304	316	in	in	ft	lb / ft
1/2	S62TP46004	S62TP66004	0.065	0.370	20	0.3
3/4	S62TP46006	S62TP66006	0.065	0.620	20	0.5
1	S62TP46010	S62TP66010	0.065	0.870	20	0.6
1-1/2	S62TP46014	S62TP66014	0.065	1.370	20	0.9
2	S62TP46020	S62TP66020	0.065	1.870	20	1.3
2-1/2	S62TP46024	S62TP66024	0.065	2.370	20	1.6
3	S62TP46030	S62TP66030	0.065	2.870	20	2.0
4	S62TP48040	S62TP68040	0.083	3.834	20	3.4
6	S62TP49060	S62TP69060	0.109	5.782	20	5.3

Stainless Pipe/Tubing - Theoretical Internal Bursting Pressures

Pipe

Nominal IPS in	Nominal O.D. in	Schedule 5S Wall in	Schedule 5S Pressure psi	Schedule 10S Wall in	Schedule 10S Pressure psi	Schedule 40S Wall in	Schedule 40S Pressure psi	Schedule 80S Wall in	Schedule 80S Pressure psi
1/8	0.405	-	-	0.049	18150	0.068	25175	0.095	35175
1/4	0.540	-	-	0.065	18050	0.088	24450	0.119	33050
3/8	0.675	-	-	0.065	14450	0.091	20225	0.126	28000
1/2	0.840	0.065	11600	0.083	14825	0.109	19475	0.147	26250
3/4	1.050	0.065	9275	0.083	11850	0.113	16150	0.154	22000
1	1.315	0.065	7425	0.109	12450	0.133	15175	0.179	20425
1-1/4	1.660	0.065	5875	0.109	9850	0.140	12650	0.191	17250
1-1/2	1.900	0.065	5125	0.109	8600	0.145	11450	0.200	15800
2	2.375	0.065	4100	0.109	6875	0.154	9750	0.218	13775
2-1/2	2.875	0.083	4325	0.120	6250	0.203	10600	0.276	14400
3	3.500	0.083	3550	0.120	5150	0.216	9250		
3-1/2	4.000	0.083	3100	0.120	4500	0.226	8475		
4	4.500	0.083	2750	0.120	4000	0.237	7900		
5	5.563	0.109	2950	0.134	3625	0.258	6950		
6	6.625	0.109	2475	0.134	3050	0.280	6350		
8	8.625	0.109	1900	0.148	2575	0.322	5600		
10	10.750	0.134	1875	0.165	2300	0.365	5100		
12	12.750	0.156	1825	0.180	2125	0.375	4400		
14	14.000	0.156	1675	0.188	2025				
16	16.000	0.165	1550	0.188	1775				
18	18.000	0.165	1375	0.188	1575				
20	20.000	0.188	1400	0.218	1625				
24	24.000	0.218	1375	0.250	1550				
30	30.000	0.250	1250	0.312	1550				

Bursting Pressure calculated using Barlows' formula: P= 2ST/D

P = Theoretical internal bursting pressures
S = 75,000 psi fiber stress
T = Nominal wall
D = Nominal O.D.

Tubing

Tube OD in	Wall Thickness - Inches 0.016	0.020	0.028	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134	0.156	0.188	0.250	0.313	0.375	0.500	0.750
1/8	19200	24000	39000	42000	58800													
1/4		12000	16800	21000	29400	39000	49800	57000										
5/16		9600	13440	16800	23520	31200	39780	45750										
3/8		8003	11998	14003	19598	26003	33203	38003	43598	48000								
1/2		6000	8400	10500	14700	19500	24900	28500	32700	36000								
5/8		4800	6720	8400	11760	15600	19920	22888	26160	28800	32160	37440	44880					
3/4		3998	5603	6998	9803	12997	16598	18998	21803	24000	26800	31200	37403					
1		3000	4200	5250	7350	9750	12450	14250	16350	18000	20100	23400	28050	37500				
1-1/4		2400	3360	4200	5880	7800	9960	11400	13080	14400	16080	18720	22440	30000				

Working pressures for 304 and 316 A269 tubing from -20° F and 100°
F

The ASME code suggests a safety factor of four
Example: 1/4" O.D. x 0.035 = 5250 psi
For higher temperatures, multiply work pressure by

	300° F	500° F	1000° F
304	0.828	0.744	0.665
316	0.900	0.853	0.746

Welded Outlet Fittings
For Fire Protection & Other Low Pressure Piping Systems

SPF Welded Outlet Fittings offer the user a high strength, low cost forged threaded and grooved line of fittings specifically designed and manufactured to be installed on proprietary thin wall flow pipe, Schedule 5, 10, and 40 standard wall pipes.

SPF Welded Outlets are forged steel welding outlet fittings. The material used in manufacture meets the chemical and physical requirements of ASTM A 53. SPF Welded Outlet Fittings employ a low weld volume design to provide either a partial or full penetration weld employing a single pass with minimum burn-through and pipe distortion. Threads comply with ANSI B1.20.1. The SPF Welded Outlets are UL Listed and FM Approved for use conforming to the requirements of NFPA 13. SPF Welded Outlet Fittings are rated for 300 psi when used in fire sprinkler system applications.

c UL us LISTED FM APPROVED

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SPF Welded Outlet Fittings

Outlet Model	Outlet Pipe Size	Header Pipe Size	Rated Pressure
	In.	In.	psig
MTM-40	½, ¾, 1	½ - 8 (Sch. 10, 40)	300
	1¼, 1½, 2, 2½, 3, 4	½ - 4 (Sch. 5, DynaFlow)	
	2	4, 6 (EZ-Flow)	
GR-40	1 - 8	1¼ - 8 (Sch. 10, 40)	300
	2½ - 8	2½ - 8 (Sch. 5, DynaFlow)	

1. Size-on size (i.e. 2 x 2) SPF Welded Outlet Fittings are not FM Approved.
2. FM rated working pressure when welded on Sch. 5 or lightwall pipe is 175 psi.
3. Refer to the UL and FM websites for the most current pressure ratings.

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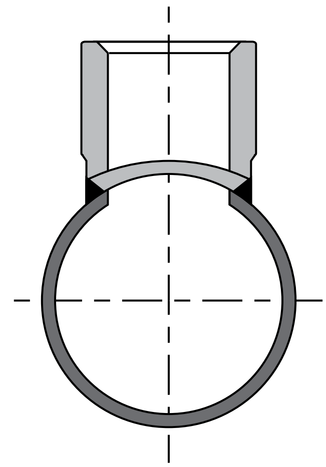
PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ Approved
Address:	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	Remarks:
Submittal Date:	
Notes 1:	
Notes 2:	

Welded Outlet Fittings



SPF Welded Outlets are designed and Manufactured to reduce the amount of weld required to install the Tee-Lets on thin wall or proprietary flow pipe. Typically only one weld-pass completes the installation. SPF Welded Outlets install with less weld volume than any other brand of welding outlet fittings for fire sprinkler applications.
To accomplish this:

- The contoured end of the fittings employs a reduced outside diameter. Two major advantages are immediately apparent.
- The thinner wall on the contoured end permits welding temperatures to be matched to the thickness of the branch line or main thereby insuring complete penetration without cold welds, weld }roll-off, burn-through or excessive distortion.
- On smaller sizes a heavier section is maintained on the threaded end of the fitting. This protects the threads from damage during shipping and handling prior to installation as well as from weld distortion.
- Each outlet size 1½" and larger, whether female threaded, cut grooved or beveled requires the same hole size in the header pipe. This simplifies the installation process.

General Specifications

- Welded outlet fittings are manufactured from highly weldable steel which conforms to the chemical and physical requirements of ASTM A-53, Grades A or B, Type E. Ease of installation is assured when automatic welding equipment is used to install SPF Welded Outlets.
- Threads are cut in accordance with the requirements of ANSI B1.20.1, national standard for tapered pipe threads.
- SPF Welded Outlets threaded and grooved welding outlet fittings are UL/ULC Listed and FM Approved for use in the fire sprinkler systems installed in accordance with the requirements of NFPA 13. They are rated for 300 PSI operation in fire sprinkler systems, and higher pressures in other non-critical piping systems.
- SPF Welded Outlets are offered in a wide variety of header sizes. The consolidated header sizes shown in the following charts allow the fittings to be installed on more than one header size, permitting the first size listed to fit the header perfectly, while a small gap along the longitudinal center line of the header will appear for the second size listed.
- SPF Welded Outlets are identified by a lot number that provides full traceability.

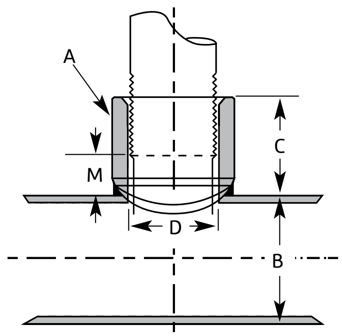
For Your Piping Systes Specify SPF Welded Outlets

Branch Outlet Fittings shall be SPF Welded Outlets, Lightweight forged steel, employing low weld volume profile to provide for full penetration welds with minimum burn through and pipe distortion on Schedule 5 thru 10, proprietary thin wall, and standard wall pipe. Threads are to be ANSI B1.20.1 and the bore of the fittings calculated to improve flow. Welding outlets to be UL Listed, FM Approved for use conforming to NFPA 13, and pressure rated for 300 psi maximum.

ASC Engineered Solutions™

Welded Outlet Fittings

MTM-40
Female Thread



SPF Welded Outlets – MTM-40

Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Make Up M	Weight Each
In./mm	In./mm	In./mm	In./mm	In./mm	Lbs./kg
½ x 13 x	1¼ – 1½ 32 – 40	1.063 27.0	0.700 17.8	0.500 12.7	0.171 0.08
	1½ – 2 40 – 50	1.063 27.0	0.700 17.8	0.500 12.7	0.171 0.08
	2 – 2½ 50 – 65	1.063 27.0	0.700 17.8	0.500 12.7	0.171 0.08
	2½ – 8 65 – 200	1.063 27.0	0.700 17.8	0.500 12.7	0.169 0.08
¾ x 19 x	1¼ – 1½ 32 – 40	1.125 28.6	0.900 22.9	0.500 12.7	0.260 0.12
	1½ – 2 40 – 50	1.125 28.6	0.900 22.9	0.500 12.7	0.260 0.12
	2 – 2½ 50 – 65	1.125 28.6	0.900 22.9	0.500 12.7	0.260 0.12
	2½ – 8 65 – 200	1.125 28.6	0.900 22.9	0.500 12.7	0.256 0.12
1 x 25 x	1¼ – 1½ 32 – 40	1.250 31.8	1.145 29.1	0.500 12.7	0.331 0.15
	1½ – 2 40 – 50	1.250 31.8	1.145 29.1	0.500 12.7	0.331 0.15
	2 – 2½ 50 – 65	1.250 31.8	1.145 29.1	0.500 12.7	0.320 0.15
	2½ – 3 65 – 80	1.250 31.8	1.145 29.1	0.500 12.7	0.314 0.14
	3 – 4 80 – 100	1.250 31.8	1.145 29.1	0.500 12.7	0.309 0.14
	5 – 8 125 – 200	1.250 31.8	1.145 29.1	0.500 12.7	0.291 0.13
1¼ x 32 x	1¼ – 1½ 32 – 40	1.375 34.9	1.490 37.8	0.500 12.7	0.432 .019
	1½ – 2 40 – 50	1.375 34.9	1.490 37.8	0.500 12.7	0.421 .019
	2 – 2½ 50 – 65	1.375 34.9	1.490 37.8	0.500 12.7	0.421 .019
	2½ – 3 65 – 80	1.375 34.9	1.490 37.8	0.500 12.7	0.411 .019
	3 – 4 80 – 100	1.375 34.9	1.490 37.8	0.500 12.7	0.389 .018
	5 – 8 125 – 200	1.375 34.9	1.490 37.8	0.500 12.7	0.389 .018

SPF Welded Outlets – MTM-40

Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Make Up M	Weight Each
In./mm	In./mm	In./mm	In./mm	In./mm	Lbs./kg
1½ x 40 x	1½ 40	1.625 41.3	1.610 40.9	0.875 22.2	0.477 .022
	2 50	1.625 41.3	1.610 40.9	0.875 22.2	0.477 .022
	2½ 65	1.625 41.3	1.610 40.9	0.875 22.2	0.477 .022
	3 – 4 80 – 100	1.625 41.3	1.610 40.9	0.875 22.2	0.477 .022
	4 100	1.625 41.3	1.610 40.9	0.875 22.2	0.477 .022
	5 – 8 125 – 200	1.625 41.3	1.610 40.9	0.875 22.2	0.477 .022
2 x 50 x	2 50	1.750 44.5	2.067 52.5	0.875 22.2	0.857 0.38
	2½ 65	1.750 44.5	2.067 52.5	0.875 22.2	0.829 0.38
	3 80	1.750 44.5	2.067 52.5	0.875 22.2	0.829 0.39
	4 100	1.750 44.5	2.067 52.5	0.875 22.2	0.800 0.36
	6 150	1.750 44.5	2.067 52.5	0.875 22.2	0.743 0.34
	8 200	1.750 44.5	2.067 52.5	0.875 22.2	0.743 0.34

Note: For Listings/Approval Details and Limitations, visit our website at www.asc-es.com or contact an ASC Engineered Solutions™ Sales Representative.

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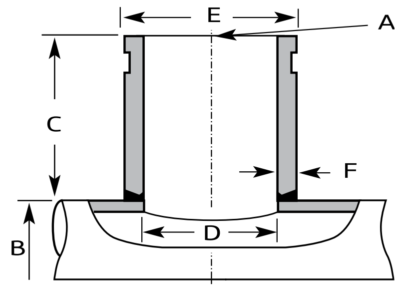
Welded Outlet Fittings

GR-40
Cut Groove
Standard Weight



SPF Welded Outlets – GR-40 (Nominal Sizes 1¼" thru 8")

Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Outside Diameter E	Wall Thickness F
In./mm	In./mm	In./mm	In./mm	In./mm	In./mm
1¼ x	1¼	3	1.368	1.660	0.140
32 x	32	80	34.7	42.2	3.6
	1½	3	1.368	1.660	0.140
	40	80	34.7	42.2	3.6
	2 - 2½	3	1.368	1.660	0.140
	50 - 65	80	34.7	42.2	3.6
	3 - 4	3	1.368	1.660	0.140
	80 - 100	80	34.7	42.2	3.6
	5 - 8	3	1.368	1.660	0.140
	125 - 200	80	34.7	42.2	3.6
1½ x	1½	3	1.610	1.900	0.145
40 x	40	80	40.9	48.3	3.7
	2	3	1.610	1.900	0.145
	50	80	40.9	48.3	3.7
	2½	3	1.610	1.900	0.145
	65	80	40.9	48.3	3.7
	3 - 4	3	1.610	1.900	0.145
	80 - 100	80	40.9	48.3	3.7
	5 - 8	3	1.610	1.900	0.145
	125 - 200	80	40.9	48.3	3.7
2 x	2	3	2.067	2.375	0.154
50 x	50	80	52.5	60.3	3.9
	2½	3	2.067	2.375	0.154
	65	80	52.5	60.3	3.9
	3	3	2.067	2.375	0.154
	80	80	52.5	60.3	3.9
	4	3	2.067	2.375	0.154
	100	80	52.5	60.3	3.9
	6	3	2.067	2.375	0.154
	150	80	52.5	60.3	3.9
	8	3	2.067	2.375	0.154
	200	80	52.5	60.3	3.9

SPF Welded Outlets – GR-40 (Nominal Sizes 1¼" thru 8")

Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter – D		Outside Diameter E	Wall Thickness – F	
			Standard Weight	Schedule 10		Standard Weight	Schedule 10
In./mm	In./mm	In./mm	In./mm	In./mm	In./mm	In./mm	In./mm
2½ x	2½	3	2.469	2.635	2.875	0.203	0.120
65 x	65	80	62.7	67.0	76.2	5.0	3.0
	4	3	2.469	2.635	2.875	0.203	0.120
	100	80	62.7	67.0	76.2	5.0	3.0
	6	3	2.469	2.635	2.875	0.203	0.120
	175	80	62.7	67.0	76.2	5.0	3.0
	8	3	2.469	2.635	2.875	0.203	0.120
	200	80	62.7	67.0	76.2	5.0	3.0
3 x	3	3	3.068	3.260	3.500	0.216	0.120
80 x	80	80	78.0	83.0	88.0	5.0	3.0
	4	3	3.068	3.260	3.500	0.216	0.120
	100	80	78.0	83.0	88.0	5.0	3.0
	6	3	3.068	3.260	3.500	0.216	0.120
	150	80	78.0	83.0	88.0	5.0	3.0
	8	3	3.068	3.260	3.500	0.216	0.120
	200	80	78.0	83.0	88.0	5.0	3.0
4 x	4	4	4.026	4.260	4.500	0.237	0.120
100 x	100	100	102.0	108.0	114.0	6.0	3.0
	6	4	4.026	4.260	4.500	0.237	0.120
	150	100	102.0	108.0	114.0	6.0	3.0
	8	4	4.026	4.260	4.500	0.237	0.120
	200	100	102.0	108.0	114.0	6.0	3.0
6 x	6	4	6.065	6.357	6.625	0.280	0.134
150 x	150	100	155.0	161.5	168.3	7.1	3.0
	8	4	6.065	6.357	6.625	0.280	0.134
	200	100	155.0	161.5	168.3	7.1	3.0
8 x	8	4	7.981	8.329	8.625	0.322	0.148
200 x	200	100	203.0	212.0	213.0	8.0	3.0

Note: Welded Outlets are manufactured to fit size-on-size, that is the contoured shape on a given Welded Outlet is made to fit perfectly on the first listed header size. If installed on the second header size marked on the fitting, a slight gap of approximately 1/32" will appear along the longitudinal centerline of the header. For example, a 1" x 2 - 2½" Welded Outlet, is a 1" outlet fitting manufactured to fit perfectly on the 2" header size listed, while leaving a 1/32" gap along the longitudinal centerline of the 2½" size. If a perfect fit is required for a 2½" header pipe, then a 1" x 2½ - 3" Welded Outlet would be ordered. Size consolidations are employed to reduce inventory and provide for greater flexibility.
(Additional larger sizes on next page.)

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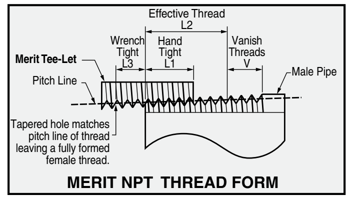
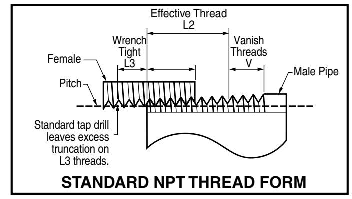
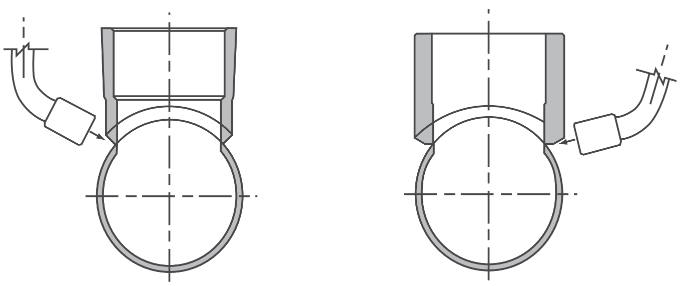
Welded Outlet Fittings





Threading Practice

SPF Welded Outlets thread form is consistent with Aeronautical National Form (ANPT) AS71051. The thread is fully formed over both the L-1 hand tight and L-3 wrench tight threads. NPT tapered threads are typically gauged only over the L-1 threads. This makes SPF Welded Outlets more forgiving of field cut threaded pipe that may only marginally conform to the specification. Fewer leaks translate into lower costs.



NPT Tapered Pipe Threads

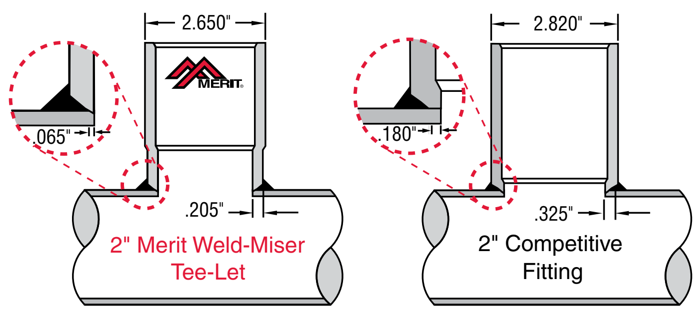
Drop Nipple or Tee-Let Outlet Size	L1 Hand Tight		L3 Wrench Tight		Total L1 – L3 Length		L2 Effective Threads	
In./mm	In./mm	Threads	In./mm	Threads	In./mm	Threads	In./mm	Threads
½	0.320	4.48	0.214	3.00	0.534	7.48	0.534	7.47
15	8.1		5.4		13.6		13.6	
¾	0.339	4.75	0.214	3.00	0.553	7.75	0.546	7.64
20	8.6		5.4		14.0		13.9	
1	0.400	4.60	0.261	3.00	0.661	7.60	0.683	7.85
25	10.2		6.6		16.8		17.3	
1¼	0.420	4.83	0.261	3.00	0.681	7.83	0.707	8.13
32	10.7		6.6		17.3		18.0	
1½	0.420	4.83	0.261	3.00	0.697	7.83	0.724	8.32
40	10.7		6.6		17.7		18.4	
2	0.436	5.01	0.261	3.00	0.706	8.01	0.757	8.70
50	11.1		6.6		17.9		19.2	
2½	0.682	5.46	0.250	2.00	0.932	7.46	1.138	9.10
65	17.3		6.4		23.7		28.9	
3	0.766	6.13	0.250	2.00	1.016	8.13	1.200	9.60
80	19.5		6.4		25.8		30.5	
4	0.844	6.75	0.250	2.00	1.094	8.75	1.300	10.40
100	21.4		6.4		27.8		33.0	

Ease of Installation

SPF Welded Outlets are designed to sit higher on the pipe, thereby requiring less weld and eliminating burn through. SPF Welded Outlets sit higher on the header or branch line pipe than competitive fittings. This allows the welding torch to remain in an optimum position for welding. In addition, 1½" and larger female threaded and grooved welded outlets require the same hole size for installation. This results in fewer change overs when installed using automatic welders.

Welding Practice

When measured with respect to linear inches of weld required for installation, SPF Welded Outlets require up to 15% less weld than competitive fittings. This reduces time and savings over time are substantial. The diameter of the contoured end of Welded Outlet has been reduced so that the wall thickness more nearly matches the header or branch line pipe wall thickness. Therefore, current and voltage settings required for welding are set to provide for adequate penetration without burn through and cold shutting. Also, weld volume required for installation is lower for SPF Welded Outlets than most other fittings. Typically, SPF Welded Outlets require one-weld pass for attachment.



Welding Practice

Outlet Size	SPF Welded Outlets				Competitive Fitting			
	Weld Volume*		Linear Welding		Weld Volume*		Linear Welding	
In. (mm)	Cross Sec. Area	%less	In.(mm)	%less	Cross Sec. Area	%more	In.(mm)	%less
1"	0.051 sq. in.	12%	2.48	0%	0.058 sq. in.	12%	2.48	0%
25	32.9 sq mm		62.9		37.4 sq mm		62.9	
1¼"	0.032"	48%	2.88	4%	0.063	48%	3.01	4%
32	20.6		73.1		40.6		76.4	
1½"	0.036"	40%	3.12	10%	0.060	40%	3.46	10%
40	23.2		79.2		38.7		87.8	
2"	0.040"	62%	3.77	15%	0.106	62%	4.41	15%
50	25.8		95.7		68.3		112.0	

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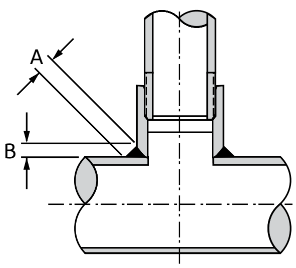
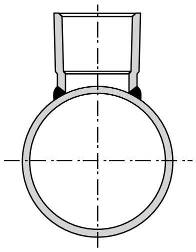
Welded Outlet Fittings



½, ¾ & 1 Outlet



1¼ – 2 Outlet

Recommended Installation Procedures

SPF Welded Outlet Fittings are designed and manufactured to reduce the cost of installation from both the standpoint of labor required and energy consumed. In addition, by following the recommended installation procedures, many of the problems associated with installing welding outlet fittings on standard weight or light weight pipe are eliminated, including burn through and excessive shrinkage resulting in pipe distortion.

Recommended Hole Sizes

The hole cut in the branch or header pipe can be cut prior or subsequent to attachment of the Welded Outlets. One advantage of cutting the hole after welding is that the pipe is left intact during welding, thereby, reducing shrinkage and possible distortion. If holes are cut prior to welding, as some codes require, then the following hole sizes are recommended.

Recommended Welding Procedures

SPF Welded Outlet Fittings are designed to be installed on standard weight or light weight pipe with one weld pass on sizes through 4" Moreover, the wall thickness at the weld end of the fitting approximately matches standard weight pipe.

Accordingly, heat settings can be made to optimize penetration on both the fitting and the pipe which it is being welded. Aside from reducing the likelihood of burn through and distortion resulting from excessive heat, the amount of weld required for adequate penetration is significantly reduced.

As a general rule, the weld should be only as hot as required to allow the weld to penetrate the materials being welded while concomitantly allowing gases developed in the welding process to escape. Every effort must be made to avoid welding too hot or overheating both thepipe and the Welded Outlets. Excessive heat may cause the wrench tight threads (those in the bottom of the Welded Outlets near the weld zone) to distort while also causing the branch pipe to bend. It should be noted that SPF Welded Outlet Fittings have been subjected to exhaustive testing and evaluation, and only negligibly distort when subjected to excessive heat. The threads, on the other hand, may not return to their gauged form after cooling if excessive heat causes them to expand. The following is intended only as a guide, and assumes that the welding equipment is properly calibrated and functioning normally and the operator is qualified.

Note: Please refer to www.asc-es.com or latest catalog for recommended hole size and welding practice.

Recommended Amount of Weld

Outlet Size	A	B
In./mm	In./mm	In./mm
1	1/4	3/16
25	7	5
1¼	1/4	3/16
31	7	5
1½	5/16	1/4
38	8	7
2	5/16	1/4
50	8	7
2½	5/16	1/4
63	8	7
3	3/8	5/16
75	10	8
4	3/8	5/16
100	10	8

Recommended Outlet Hole Sizes

Welded Outlet Size	Type	Recommended Hole Size
In./mm		In./mm
½	MTM-40	5/8
13		16
¾	MTM-40	7/8
19		22
1	MTM-40	1⅛
25		28
1¼	MTM-40	1½
31		38
1¼	GR-40	1⅜
31		35
1½	MTM-40 or GR-40	1⅝
38		41
2	MTM-40 or GR-40	2
50		50
2½	GR-40	2 7/16
63		61
3	GR-40	3
75		75
4	GR-40	4
100		100

Note: Holes may be cut employing mechanical means – including hole sawing, mechanical flame cutting (oxy-acetylene or propane), and air plasma cutting (constricted tungsten arc) machines. Anvil offers a simple approach to cutting the hole. Hand-held templates are sized to match your plasma cutter.

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Welded Outlet Fittings

Recommended Settings For Microwire Welding Process

Header Size	Pipe Wall Thickness	Welded Outlet MTM-40 & GR-40	Electrode Size	Welding Current	Arc. Volts	Wire Feed	Travel Speed
In./mm	In./mm	In./mm		AMPS-DC	POS.	IPM	IPM
1¼ - 2 31-50	0.065 2	½ - 2 13-50	0.035	100-130	16-20	210	25-30
		2½ - 4 63-100	0.035	115-150	17-21	270	20-25
	0.109 3	½ - 2 13-50	0.035	110-140	18-22	220	25-30
		2½ - 4 63-100	0.035	120-160	19-22	290	20-25
2½ - 4 63-100	0.083 2.5	½ - 2 13-50	0.035	110-140	17-20	210	20-25
		2½ - 4 63-100	0.035	120-150	17-20	270	20-25
	0.120 3	½ - 2 13-50	0.035	120-160	19-22	290	20-25
		2½ - 4 63-100	0.035	130-160	19-22	240	20-25
5-6 125-150	0.109 3	½ - 2 13-50	0.035	120-150	17-20	210	20-25
		2½ - 4 63-100	0.035	130-150	18-20	270	15-20
	0.134 3.5	½ - 2 13-50	0.035	130-160	19-22	290	20-25
		2½ - 4 63-100	0.035	140-160	20-22	270	15-20
		2½ - 4 63-100	0.045	180-205	20-24	245	27-32
8 200	0.109 3	½ - 2 13-50	0.035	120-150	17-20	240	20-25
		2½ - 4 63-100	0.035	130-150	18-20	260	15-20
		2½ - 4 63-100	0.045	170-220	18-22	290	12-18
	0.148 3.5	½ - 2 13-50	0.035	130-160	19-22	240	20-25
		2½ - 4 63-100	0.035	140-160	20-22	260	15-20
		2½ - 4 63-100	0.045	180-225	20-24	290	12-18

Note:
Shielding Gas Flow (For all Sizes) 20-25 CFH
1) CO_2 – Deeper penetration, faster welding, low cost.
2) 25% – Argon, 75% – CO_2, Recommended for .134 wall and lighter, high welding speeds without melt through, minimum distortion and spatter, good penetration.

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Fig. 3201 90˚ Elbow

For Listings/Approval Details and Limitations, visit our website at www.asc-es.com or contact an ASC Engineered Solutions™ Sales Representative.

Material Specifications

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

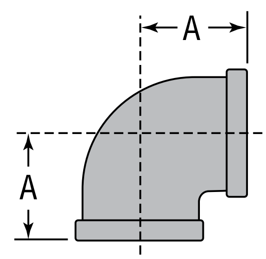
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

Figure 3201 90˚ Elbow

Nominal Size	Maximum Working Pressure ▲	Dimension A	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	Lbs. (kg)
1 20	500 3450	1.50 38.10	0.62 0.68
1¼ 32	500 3450	1.75 44.45	0.90 0.41
1½ 40	500 3450	1.94 49.276	1.20 0.54
2 50	500 3450	2.25 57.15	1.85 0.84

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.



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Contractor:	☐ Not approved
Engineer:	Remarks:
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Notes 1:	
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ASC Engineered Solutions

Reducing 90˚ Elbow
Fig. 3201R

Material Specifications

- **Dimensions:** ASME B16.3
- **Material:** ASTM A536 Grade 65-45-12
- **Finish:** Black
- **Threads:** NPT per ASME B1.20.1
- **Agency Approvals:** All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

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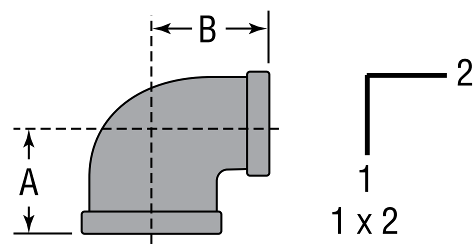
Fig. 3201R Reducing 90˚ Elbow

Nominal Size 1 x 2	Max. Working Pressure ▲	Dimensions A	Dimensions B	Approx Wt. Each
In. (mm)	PSI (kPa)	In. (mm)	In. (mm)	Lbs. (kg)
1 x ½ 25 x 15	500 3450	1.26 32.00	1.36 34.54	0.44 0.20
1 x ¾ 25 x 20	500 3450	1.37 34.79	1.45 36.83	0.52 0.24
1¼ x ½ 32 x 15	500 34550	1.34 34.03	1.53 38.86	0.64 0.29
1¼ x ¾ 32 x 20	500 3450	1.45 36.83	1.62 41.14	0.72 0.33
1¼ x 1 32 x 25	500 3450	1.58 40.13	1.67 42.41	0.75 0.34
1½ x ½ 40 x 15	500 3450	1.41 35.81	1.66 42.16	0.64 0.29
1½ x ¾ 40 x 20	500 3450	1.52 38.61	1.75 44.45	0.77 0.35
1½ x 1 40 x 25	500 3450	1.65 41.91	1.80 45.72	0.92 0.42
1½ x 1¼ 40 x 32	500 3450	1.82 46.22	1.88 47.75	1.08 0.49
2 x ½ 50 x 15	500 3450	1.49 37.84	1.88 47.75	1.08 0.49
2 x ¾ 50 x 20	500 3450	1.60 40.64	1.97 50.03	1.24 0.56
2 x 1 50 x 25	500 3450	1.73 43.94	2.02 51.30	1.40 0.64
2 x 1¼ 50 x 32	500 3450	1.90 48.26	2.10 53.34	1.52 0.70
2 x 1½ 50 x 40	500 3450	2.02 51.30	2.16 54.86	1.65 0.75



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▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit www.asc-es.com or contact your local ASC Engineered Solutions™ Representative.

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45° Elbow
Fig. 3202

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Material Specifications

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

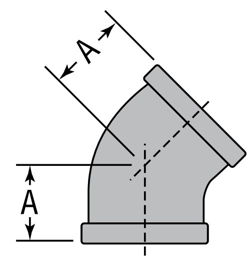
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

Figure 3202 45° Elbow

Nominal Size	Maximum Working Pressure ▲	Dimension A	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	Lbs. (kg)
1 25	500 3450	1.12 28.44	0.46 0.21
1¼ 32	500 3450	1.29 32.76	0.73 0.33
1½ 40	500 3450	1.43 36.32	0.92 0.42
2 50	500 3450	1.68 42.67	1.50 0.68

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.



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SPF Ductile Iron Threaded Fittings

ASC Engineered Solutions

Straight Tee
Fig. 3205

For Listings/Approval Details and Limitations, visit our website at www.asc-es.com or contact an ASC Engineered Solutions™ Sales Representative.

Material Specifications

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

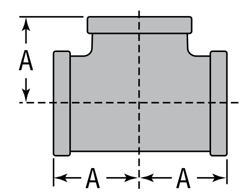
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

Figure 3205 Straight Tee

Nominal Size	Maximum Working Pressure ▲	Dimension A	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	Lbs. (kg)
1 25	500 3450	1.50 38.10	0.85 0.39
1¼ 32	500 3450	1.75 44.45	1.22 0.55
1½ 40	500 3450	1.94 49.27	1.55 0.70
2 50	500 3450	2.25 57.15	2.45 1.11

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.



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SPF Ductile Iron Threaded Fittings

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Reducing Tee
Fig. 3205R

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Material Specifications

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

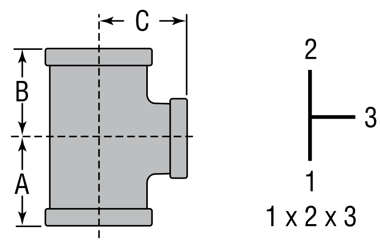

Figure 3205R Reducing Tee

Nominal Size 1 x 2 x 3	Maximum Working Pressure ▲	Dimensions A	Dimensions B	Dimensions C	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	In. (mm)	In. (mm)	Lbs. (kg)
1 x ½ x 1 25 x 15 x 25	500 3450	1.50 38.10	1.36 34.54	1.50 38.10	0.64 0.29
1 x ¾ x 1 25 x 20 x 25	500 3450	1.50 38.10	1.45 36.83	1.50 38.10	0.73 0.33
1 x 1 x ½ 25 x 25 x 15	500 3450	1.26 32.00	1.26 32.00	1.36 34.54	0.71 0.32
1 x 1 x ¾ 25 x 25 x 20	500 3450	1.37 34.80	1.37 34.80	1.45 36.83	0.76 0.34
1 x 1 x 1¼* 25 x 25 x 32	500 3450	1.67 42.41	1.67 42.41	1.58 40.13	0.98 0.44
1 x 1 x 1½* 25 x 25 x 40	500 3450	1.80 45.72	1.80 45.72	1.65 41.91	1.16 0.53
1¼ x 1 x ½* 32 x 25 x 15	500 3450	1.34 34.04	1.26 32.00	1.53 38.86	0.82 0.37
1¼ x 1 x ¾ 32 x 25 x 20	500 3450	1.45 36.83	1.37 34.80	1.62 41.15	0.90 0.41
1¼ x 1 x 1 32 x 25 x 25	500 3450	1.58 40.13	1.50 38.10	1.67 42.42	1.00 0.45
1¼x 1 x 1¼ 32 x 25 x 32	500 3450	1.75 44.45	1.67 42.42	1.75 44.45	1.08 0.49
1¼ x 1 x 1½ 32 x 25 x 40	500 3450	1.88 47.75	1.80 45.72	1.82 46.22	1.42 0.64
1¼ x 1¼ x ½ 32 x 32 x 15	500 3450	1.34 34.04	1.34 34.04	1.53 38.86	0.86 0.39

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.

*Part supplied as "Bull Head Tee".

Figure 3205R Reducing Tee

Nominal Size 1 x 2 x 3	Maximum Working Pressure ▲	Dimensions A	Dimensions B	Dimensions C	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	In. (mm)	In. (mm)	Lbs. (kg)
1¼ x 1¼ x ¾ 32 x 32 x 20	500 3450	1.45 36.83	1.45 36.83	1.62 41.15	0.92 0.42
1¼ x 1¼ x 1 32 x 32 x 25	500 3450	1.58 40.13	1.58 40.13	1.67 42.42	0.95 0.43
1¼ x 1¼ x 1½* 32 x 32 x 40	500 3450	1.88 47.75	1.88 47.75	1.82 46.22	1.45 0.66

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ASC Engineered Solutions

Reducing Tee
Fig. 3205R

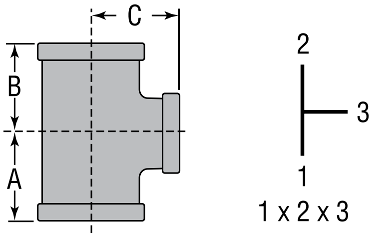

Figure 3205R Reducing Tee

Nominal Size	Maximum Working Pressure ▲	Dimensions			Approx Wt. Each
1 x 2 x 3		A	B	C	
In. (mm)	psi (kPa)	In. (mm)	In. (mm)	In. (mm)	Lbs. (kg)
1¼ x 1¼ x 2* 32 x 32 x 50	500 3450	2.10 53.34	2.10 53.34	1.90 48.26	1.75 0.79
1½ x 1 x ½ 40 x 25 x 15	500 3450	1.41 35.81	1.34 34.04	1.66 42.16	0.95 0.43
1½ x 1 x ¾ 40 x 25 x 20	500 3450	1.52 38.61	1.37 34.80	1.75 44.45	1.14 0.52
1½ x 1 x 1 40 x 25 x 25	500 3450	1.65 41.91	1.50 38.10	1.80 45.72	1.17 0.53
1½ x 1 x 1¼ 40 x 25 x 32	500 3450	1.82 46.23	1.67 42.42	1.88 47.75	1.34 0.61
1½ x 1 x 1½ 40 x 25 x 40	500 3450	1.94 49.28	1.80 45.72	1.94 49.28	1.45 0.66
1½ x 1¼x ½ 40 x 32 x 15	500 3450	1.41 35.81	1.34 34.04	1.66 42.16	1.05 0.48
1½ x 1¼ x ¾ 40 x 32 x 20	500 3450	1.52 38.61	1.45 36.83	1.75 44.45	1.15 0.5
1½ x 1¼ x 1 40 x 32 x 25	500 3450	1.65 41.91	1.58 40.13	1.80 45.72	1.25 0.57
1½ x 1¼ x 2* 40 x 32 x 50	500 3450	2.16 54.86	2.10 53.34	2.02 51.30	1.90 0.86
1½ x 1½ x ½ 40 x 40 x 15	500 3450	1.41 35.81	1.41 35.81	1.16 29.46	1.15 0.52
1½ x 1½ x ¾ 40 x 40 x 20	500 3450	1.52 38.61	1.52 38.61	1.75 44.45	1.24 0.56
1½ x 1½ x 1 40 x 40 x 25	500 3450	1.65 41.91	1.65 41.91	1.80 45.72	1.30 0.59
1½ x 1½ x 1¼ 40 x 40 x 32	500 3450	1.82 46.23	1.82 46.23	1.88 47.75	1.48 0.67
1½ x 1½ x 2* 40 x 40 x 50	500 3450	2.16 54.86	2.16 54.86	2.02 51.30	1.98 0.90
2 x 1 x 2 50 x 25 x 50	500 3450	2.25 57.15	2.02 51.31	2.25 57.15	2.15 0.98
2 x 1¼ x 2 50 x 32 x 50	500 3450	2.25 57.15	2.10 53.34	2.25 57.15	2.30 1.04
2 x 1½ x ½ 50 x 40 x 15	500 3450	1.49 37.85	1.41 35.81	1.88 47.75	1.50 0.68
2 x 1½ x ¾ 50 x 40 x 20	500 3450	1.60 40.64	1.52 38.61	1.97 50.04	1.62 0.73
2 x 1½ x 1 50 x 40 x 25	500 3450	1.73 43.94	1.65 41.91	2.02 51.31	1.64 0.74
2 x 1½ x 1¼ 50 x 40 x 32	500 3450	1.90 48.26	1.82 46.23	2.10 53.34	1.80 0.82
2 x 1½ x 1½ 50 x 40 x 40	500 3450	2.02 51.31	1.94 49.28	2.16 54.86	2.00 0.91
2 x 1½ x 2 50 x 40 x 50	500 3450	2.25 57.15	2.16 54.86	2.25 57.15	2.35 1.07
2 x 2 x ½ 50 x 50 x 15	500 3450	1.49 37.85	1.49 37.85	1.88 47.75	1.60 0.73
2 x 2 x ¾ 50 x 50 x 20	500 3450	1.60 40.64	1.60 40.64	1.97 50.04	1.68 0.76
2 x 2 x 1 50 x 50 x 25	500 3450	1.73 43.94	1.73 43.94	2.02 51.31	1.85 0.84
2 x 2 x 1¼ 50 x 50 x 32	500 3450	1.90 44.45	1.90 42.42	2.10 44.45	2.04 0.93
2 x 2 x 1½ 50 x 50 x 40	500 3450	2.02 44.45	2.02 42.42	2.16 44.45	2.18 0.99

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.

*Part supplied as "Bull Head Tee".

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Cross
Fig. 3207

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Material Specifications

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

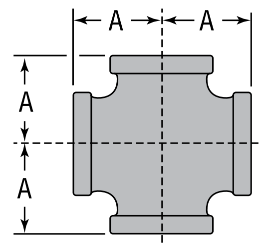
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

Figure 3207 Cross

Nominal Size	Maximum Working Pressure ▲	Dimension A	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	Lbs. (kg)
1 25	500 3450	1.50 38.10	0.98 0.44
1¼ 32	500 3450	1.75 44.45	1.50 068
1½ 40	500 3450	1.94 49.27	1.90 0.86
2 50	500 3450	2.25 57.15	2.95 1.34

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.



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Reducing Coupling
Fig. 3221R

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Material Specifications

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

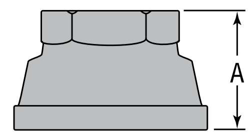
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

Figure 3221R Reducing Coupling

Nominal Size	Maximum Working Pressure ▲	Dimension A	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	Lbs. (kg)
1 x ½ 25 x 15	500 3450	1.69 42.92	0.39 0.18
1 x ¾ 25 x 20	500 3450	1.69 42.92	0.53 0.24
1¼ x ¾ 32 x 20	500 3450	2.06 52.32	0.64 0.29

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.



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PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ Approved
Address:	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	Remarks:
Submittal Date:	
Notes 1:	
Notes 2:	

Bushings
Fig. 3283

cUL US LISTED FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.asc-es.com or contact an ASC Engineered Solutions™ Sales Representative.

Material Specifications

Dimensions: ASME B16.14

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

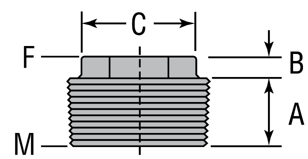
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

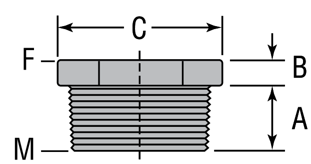
Figure 3283 Bushings

Nominal Size Male (M) x Female (F)	Maximum Working Pressure ▲	Dimensions A	Dimensions B	Dimensions C	Style	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	In. (mm)	In. (mm)	-	Lbs. (kg)
1 x ½ 25 x 15	500 3450	0.75 19.05	0.25 6.35	1.42 36.06	Outside	0.22 0.10
1 x ¾ 25 x 20	500 3450	0.75 19.05	0.25 6.35	1.42 36.06	Outside	0.17 0.08
1¼ x 1 32 x 25	500 3450	0.80 20.32	0.28 7.11	1.76 44.70	Outside	0.28 0.13
1½ x 1 40 x 25	500 3450	0.83 21.08	0.31 7.874	2.00 50.80	Outside	0.45 0.20
1½ x 1¼ 40 x 32	500 3450	0.83 21.08	0.31 7.874	2.00 50.80	Outside	0.30 0.14
2 x 1 50 x 25	500 3450	0.88 22.35	0.41 10.414	1.95 49.43	Inside	0.67 0.30
2 x 1¼ 50 x 32	500 3450	0.88 22.35	0.34 8.636	2.48 62.99	Outside	0.73 0.33
2 x 1½ 50 x 40	500 3450	0.88 22.35	0.34 8.636	2.48 62.99	Outside	0.61 0.28

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.



Inside Head



Outside Head

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Engineer:	Remarks:
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Notes 1:	
Notes 2:	

Coupling
Fig. 3221

For Listings/Approval Details and Limitations, visit our website at www.asc-es.com or contact an ASC Engineered Solutions™ Sales Representative.

Material Specifications

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

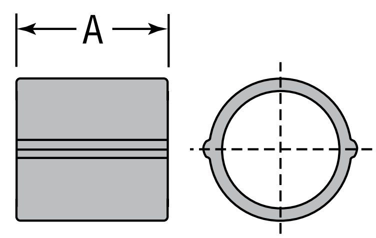
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

Figure 3221 Coupling

Nominal Size	Maximum Working Pressure ▲	Dimension A	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	Lbs. (kg)
1 25	500 3450	1.67 42.42	0.40 0.18
1¼ 32	500 3450	1.93 49.02	0.57 0.26
1½ 40	500 3450	2.15 54.61	0.75 0.34
2 50	500 3450	2.53 64.26	1.15 0.52

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.



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Contractor:	☐ Not approved
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ASC Engineered Solutions

Cored Plug
Fig. 3388

c UL us LISTED
FM APPROVED

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Material Specifications

Dimensions: ASME B16.14

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

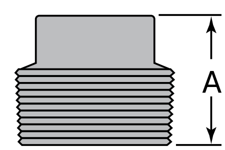
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

▲ Pressure – Temperature Ratings in accordance with ASME B16.3 Class 150

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

Figure 3388 Cored Plug

Nominal Size	Maximum Working Pressure ▲	Dimension A	Approx. Wt. Each
In. (mm)	psi (kPa)	In. (mm)	Lbs. (kg)
½* 15	500 3450	0.94 23.87	0.10 0.05
¾ 20	500 3450	1.07 27.17	0.17 0.08
1 25	500 3450	1.25 31.75	0.28 0.13
1¼ 32	500 3450	1.36 34.54	0.44 0.20
1½ 40	500 3450	1.45 36.83	0.62 0.28
2 50	500 3450	1.56 39.62	0.91 0.41



▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.

*Part supplied as Solid Plug.

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Engineer:	Remarks:
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ASC Engineered Solutions

Cap
Fig. 3224

LISTED APPROVED

For Listings/Approval Details and Limitations, visit our website at www.asc-es.com or contact an ASC Engineered Solutions™ Sales Representative.

Material Specifications

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

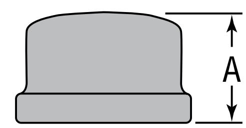
Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

Note: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

Figure 3224 Cap

Nominal Size	Maximum Working Pressure ▲	Dimension A	Approx Wt. Each
In. (mm)	psi (kPa)	In. (mm)	Lbs. (kg)
1 25	500 3450	1.16 29.46	0.32 0.15
1¼ 32	500 3450	1.28 32.51	0.43 0.20
1½ 40	500 3450	1.33 33.78	0.60 0.27
2 50	500 3450	1.45 36.83	0.91 0.41



▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit asc-es.com or contact your local ASC Engineering Solutions™ Representative.

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Contractor:	☐ Not approved
Engineer:	Remarks:
Submittal Date:	
Notes 1:	
Notes 2:	

FireLock™ Installation-Ready™ Rigid Couplings
Style 009V, Style 009N and Style 109

Style 009V
Patented

Style 009N
Patented

Style 109
Patented

1.0 PRODUCT DESCRIPTION

Available Sizes

- Style 009V: 1 ¼ – 12"/DN32 – DN300
- Style 009N: 1 ¼ – 12"/DN32 – DN300
- Style 109: 1 ¼ – 4"/DN32 – DN100

Pipe Material

- Schedule 10, Schedule 40 or specialty carbon steel pipe listed in Section 5. For use with alternative materials and wall thicknesses please contact Victaulic
- For exceptions reference section 6.0 Notifications

Maximum Working Pressure

- Accommodates pressures ranging from full vacuum (29.9 in Hg/760 mm Hg) to 365 psi/2517 kPa
- Working pressure dependent on material, wall thickness and size of pipe

Function

- Joins carbon steel pipe with grooved ends conforming to publication 25.01
- Provides a rigid pipe joint designed to restrict axial or angular movement

Pipe Preparation

- Cut or roll grooved in accordance with publication 25.01: Victaulic Standard Groove Specifications.

2.0 CERTIFICATION/LISTINGS

LPS 1219: Issue 3.1
Cert/LPCB Ref. 104-1a/36

009N: G4090023
109: G421013

EN 10311
CPR (EU)
No. 305/2011

BS EN 10311
CPR (UK)
2019 No. 465

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

3.0 SPECIFICATIONS – MATERIAL

Housing: Ductile iron conforming to ASTM A 536, Grade 65-45-12. Ductile iron conforming to ASTM A 395, Grade 65-45-15, is available upon special request.

Housing Coating: (specify choice)

- ☐ Orange coating
- ☐ Red coating (standard for EMEA-I and Asia Pacific)
- ☐ Optional for Style 009N and 009V: Galvanized per ASTM A123 (Hot Dipped) or ASTM A1059 (Thermo-Diffusion)
- ☐ Optional for Style 109: Mechanically Galvanized per ASTM B695 (available only in North America and Latin America).

Gasket: (specify choice)

☐ **Grade "E" EPDM (Type A) Vic-Plus™ Pre-lubricated Gasket**

EPDM (Violet Color Code). Applicable for wet and dry (oil-free air) fire protection systems only. Listed/Approved for continuous use in wet and dry systems. Listed/Approved for dry systems at -40°F/-40°C and above. Not compatible for use with hot water services or steam services.

NOTES

- Reference should always be made to publication I-100, Victaulic Field Installation Handbook for gasket lubrication instructions.
- Services listed are General Service Guidelines only. It should be noted that there are services for which these gaskets are not compatible. Reference should always be made to publication 05.01, Victaulic Gasket Selection Guide for specific gasket service guidelines and for a listing of services which are not compatible.
- The gasket pre-lubrication will appear white to slightly amber in color. The color will not impact gasket or coupling performance.

Bolts/Nuts: (specify choice)

☐ Standard: Carbon steel oval neck track bolts meeting the mechanical property requirements of (imperial) ASTM A449 or (metric) ISO 898-1 Class 9.8 (M10-M16) or Class 8.8 (M20 and greater). Carbon steel hex nuts meeting the mechanical property requirements of (imperial hex nuts) ASTM A563 Grade B or (metric hex nuts) ISO 898-2 Class 10 (M12-M16) or Class 8 (M20 and greater). Track bolts and hex nuts are zinc electroplated per ASTM B633 Fe/Zn5 finish (imperial) Type III or (metric) Type II.

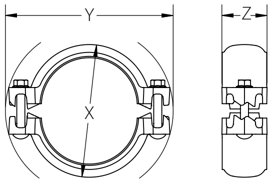
☐ Optional for Style 009N: Stainless steel oval neck track bolts meeting the requirements of ASTM F593, Group 2 (316 stainless steel), condition CW. Stainless steel Heavy Hex nuts meeting the requirements of ASTM F594, Group 2 (316 stainless steel), condition CW, with galling-resistant coating.[1]

[1] Optional bolts/nuts are available in imperial size only.

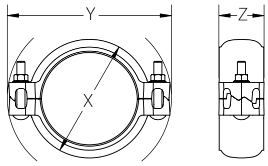
Coupling Linkage (Style 109 only): High Strength Steel with comparable physical properties to that of the Track Bolt (ASTM A449). Linkage is zinc electroplated per ASTM B633 Fe/Zn 5, Type III Finish.

4.0 DIMENSIONS

Style 009V Two-Bolt Installation-Ready Coupling



Style 009V Pre-Assembled



Style 009V Joint Assembled

Size					Bolt/Nut		Dimensions					
							Pre-Assembled		Joint Assembled			
Nominal inches DN	Actual Outside Diameter inches mm	Maximum Working Pressure[2] Lbs. N	Maximum End Load[2] inches mm	Allow. Pipe End Separation[3] psi kPa	Qty.	Size inches mm	X inches mm	Y inches mm	X inches mm	Y inches mm	Z inches mm	Approx. Weight (Each) lb kg
1 ¼ DN32	1.660 42.4	365 2517	790 3514	0.10 2.54	2	⅜ x 2 M10 x 51	3.25 82	4.81 122	2.88 74	4.75 120	2.13 54	1.7 0.8
1 ½ DN40	1.900 48.3	365 2517	1035 4604	0.10 2.54	2	⅜ x 2 M10 x 51	3.50 88	5.06 128	3.13 80	5.00 128	2.13 54	1.7 0.8
2 DN50	2.375 60.3	365 2517	1617 7192	0.12 3.05	2	⅜ x 2 ½ M10 x 63	4.06 104	5.63 142	3.63 92	5.63 142	2.13 54	2.1 1.0
2 ½	2.875 73.0	365 2517	2370 10542	0.12 3.05	2	⅜ x 2 ½	4.56 116	6.06 154	4.06 104	6.06 154	2.13 54	2.2 1.0
3 DN80	3.500 88.9	365 2517	3512 15622	0.12 3.05	2	⅜ x 2 ½ M10 x 63	5.19 132	6.81 174	4.63 118	6.69 170	2.19 56	2.6 1.2
4 DN100	4.500 114.3	365 2517	5805 25822	0.17 4.32	2	⅜ x 2 ½ M10 x 63	6.38 162	7.94 202	5.75 146	7.75 196	2.25 58	3.5 1.6
6 DN150	6.625 168.3	365 2517	12582 55968	0.17 4.32	2	½ x 3 M12 x 76	9.00 228	10.69 272	8.31 212	10.56 268	2.31 58	6.3 2.9
8 DN200	8.625 219.1	365 2517	21326 94862	0.17 4.32	2	⅝ x 3 ⅝ M16 x 92	11.31 288	13.75 350	10.56 268	13.63 346	2.81 72	13.0 5.9
10 DN250	10.750 273.0	365 2517	33127 147358	0.25 6.4	2	⅞ x 6 M22 x 152	14.13 358	17.50 444	13.25 336	17.13 434	2.94 74	25.0 11.5
12 DN300	12.750 323.9	365 2517	46600 207290	0.25 6.4	2	⅞ x 6 M22 x 152	16.38 416	19.50 496	15.63 396	19.25 488	2.94 74	30.0 13.5

2 Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. See the Listings/Approvals section of this publication for ratings on other pipe.

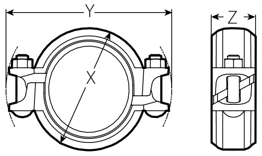
3 The allowable pipe separation dimension shown is for system layout purposes only. Style 009V couplings are considered rigid connections and will not accommodate expansion or contraction of the piping system.

NOTES

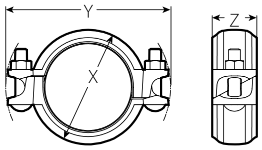
- When assembling Style 009V, Style 009N or Style 109 couplings onto end caps, take additional care to make certain the end cap is fully seated against the gasket end stop. For Style 009V, Style 009N couplings, use FireLock No. 006 end caps containing the "EZ" marking on the inside face or No. 60 end caps containing the "QV EZ" marking on the inside face. Non-Victaulic end cap products shall not be used with Style 009V, Style 009N or Style 109 couplings. IMPORTANT: Gaskets intended for the Style 009 or Style 009V couplings cannot be used with the Style 009N or Style 109 coupling. There is no interchanging of gaskets or housings between coupling styles.
- **Use Of FlushSeal Gaskets For Dry Pipe Systems** Style 009V, Style 009N or Style 109 couplings are supplied with Grade "E" Type A gaskets. These gaskets include an integral pipe stop, that once installed provides the similar benefits as a FlushSeal gasket for dry pipe systems. It should be noted that standard Victaulic FlushSeal gaskets cannot be used with the Style 009V, Style 009N or Style 109 couplings.
- The Allowable Pipe End Separation dimension shown is for system layout purposes only. Style 009V, Style 009N or Style 109 Installation-Ready rigid couplings are considered rigid connections and will not accommodate expansion/contraction or angular movement of the piping system. Contact Victaulic for torsional resistance information.

4.1 DIMENSIONS

Style 009N Two-Bolt *Installation-Ready* Coupling



Style 009N Pre-Assembled



Style 009N Joint Assembled

Size					Bolt/Nut		Dimensions					
							Pre-assembled		Joint Assembled			
Nominal inches DN	Actual Outside Diameter inches mm	Maximum Working Pressure[2] psi kPa	Maximum End Load[2] lb N	Allow. Pipe End Separation[3] inches mm	Qty.	Size inches mm	X inches mm	Y inches mm	X inches mm	Y inches mm	Z inches mm	Approx. Weight (Each) lb kg
1 ¼ DN32	1.660 42.4	365 2517	790 3514	0.10 2.54	2	⅜ × 2 M10 x 51	3.13 79	5.00 127	2.75 70	5.00 127	2.00 51	1.4 0.6
1 ½ DN40	1.900 48.3	365 2517	1035 4604	0.10 2.54	2	⅜ × 2 M10 x 51	3.38 86	5.13 130	3.00 76	5.13 130	2.00 51	1.5 0.7
2 DN50	2.375 60.3	365 2517	1617 7193	0.12 3.05	2	⅜ × 2 ½ M10 x 63	4.00 102	5.63 143	3.50 89	5.63 143	2.00 51	1.9 0.9
2 ½	2.875 73.0	365 2517	2370 10542	0.12 3.05	2	⅜ × 2 ½ M10 x 63	4.50 114	6.13 156	4.00 102	6.13 156	2.00 51	2.1 1.0
DN65	3.000 76.1	365 2517	2580 11476	0.12 3.05	2	⅜ × 2 ½ M10 x 63	4.63 118	6.00 152	4.13 105	6.13 156	2.00 51	2.1 1.0
3 DN80	3.500 88.9	365 2517	3512 15622	0.12 3.05	2	⅜ × 2 ½ M10 x 63	5.13 130	6.75 171	4.63 117	6.75 171	2.00 51	2.3 1.0
4 DN100	4.500 114.3	365 2517	5805 25822	0.17 4.32	2	⅜ × 2 ½ M10 x 63	6.00 152	7.88 200	5.63 143	7.50 191	2.13 54	2.9 1.3
	4.250 108.0	365 2517	5178 23020	0.17 4.32	2	⅜ × 2 ½ M10 x 63	5.63 152	7.38 1.87	5.38 137	7.38 187	2.13 54	3.1 1.4
5	5.563 141.3	365 2517	8872 39456	0.17 4.32	2	½ × 3 M12 x 76	7.25 184	9.25 235	6.75 171	9.13 232	2.25 57	5.0 2.3
	5.250 133.0	365 2517	7901 35106	0.17 4.32	2	½ × 3 M12 x 76	6.63 168	9.00 229	6.38 162	9.00 229	2.25 57	4.8 2.2
DN125	5.500 139.7	365 2517	8672 38529	0.17 4.32	2	½ × 3 M12 x 76	6.88 175	9.25 235	6.75 171	9.13 232	2.25 57	4.9 2.2
6 DN150	6.625 168.3	365 2517	12582 44469	0.17 4.32	2	½ × 3 ¼ M12 x 83	8.38 213	10.38 264	7.88 200	10.13 257	2.25 57	6.0 2.7
	6.250 159.0	365 2517	11198 49753	0.17 4.32	2	½ × 3 ¼ M12 x 83	7.88 200	10.00 254	7.38 187	9.88 251	2.25 57	5.6 2.5
	6.500 165.1	365 2517	12112 53813	0.17 4.32	2	½ × 3 ¼ M12 x 83	8.00 203	10.25 260	7.75 197	10.13 257	2.25 57	6.0 2.7
8 DN200	8.625 219.1	365 2517	21326 94863	0.17 4.32	2	⅝ × 4 M16 x 101	10.88 276	13.38 340	10.25 260	13.13 333	2.50 64	11.4 5.2
	8.515 216.3	365 2517	20712 55968	0.17 4.32	2	⅝ × 4 M16 x 101	10.63 270	13.25 337	10.25 260	10.13 257	2.63 67	11.4 5.2
10 DN250	10.750 273.0	300 2068	27229 121121	0.25 6.4	2	⅞ × 6 ½ M22 x 165	13.75 349	17.00 432	13.25 337	17.13 435	2.75 70	22.6 10.3
12 DN300	12.750 323.9	300 2068	38303 170380	0.25 6.4	2	⅞ × 6 ½ M22 x 165	16.00 406	19.00 483	15.50 394	19.13 486	2.75 70	27.6 12.5

[2] Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. See the Listings/Approvals section of this publication for ratings on other pipe.

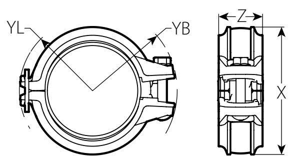
[3] The allowable pipe separation dimension shown is for system layout purposes only. Style 009N couplings are considered rigid connections and will not accommodate expansion or contraction of the piping system.

NOTES

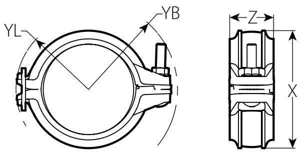
- When assembling Style 009V, Style 009N or Style 109 couplings onto end caps, take additional care to make certain the end cap is fully seated against the gasket end stop. For Style 009V, Style 009N couplings, use FireLock No. 006 end caps containing the "EZ" marking on the inside face or No. 60 end caps containing the "QV EZ" marking on the inside face. Non-Victaulic end cap products shall not be used with Style 009V, Style 009N or Style 109 couplings. IMPORTANT: Gaskets intended for the Style 009 or Style 009V couplings cannot be used with the Style 009N or Style 109 coupling. There is no interchanging of gaskets or housings between coupling styles.
- **Use Of FlushSeal Gaskets For Dry Pipe Systems** Style 009V, Style 009N or Style 109 couplings are supplied with Grade "E" Type A gaskets. These gaskets include an integral pipe stop, that once installed provides the similar benefits as a FlushSeal gasket for dry pipe systems. It should be noted that standard Victaulic FlushSeal gaskets cannot be used with the Style 009V, Style 009N or Style 109 couplings.
- The Allowable Pipe End Separation dimension shown is for system layout purposes only. Style 009V, Style 009N or Style 109 Installation-Ready rigid couplings are considered rigid connections and will not accommodate expansion/contraction or angular movement of the piping system. Contact Victaulic for torsional resistance information.

4.2 DIMENSIONS

Style 109 One-Bolt *Installation-Ready* Coupling



Style 109 Pre-Assembled



Style 109 Joint Assembled

Size		Max. Working Pressure	Max. End Load	Allow. Pipe End Sep. Maximum	Bolt/Nut		Dimensions								Weight
							Pre-Assembled				Assembled				
Nominal inches DN	Actual Outside Diameter inches mm	Max. Working Pressure psi kPa	Max. End Load Lbs. N	Allow. Pipe End Sep. Maximum inches mm	Qty.	Size inches mm	YL inches mm	YB inches mm	X inches mm	Z inches m m	YL inches mm	YB inches mm	X inches mm	Z inches mm	Approx. (Each) lb kg
1 ¼ DN32	1.660 42.4	365 2517	790 3514	0.10 2.54	1	⅜ x 2 ¼ M10 x 57	1.97 50	2.49 63	3.17 81	1.95 50	1.93 49	2.59 66	2.84 72	1.95 50	1.5 0.7
1 ½ DN40	1.900 48.3	365 2517	1035 4603	0.10 2.54	1	⅜ x 2 ¼ M10 x 57	2.13 54	2.60 66	3.41 87	1.95 50	2.1 53	2.68 68	3.07 78	1.95 50	1.6 0.7
2 DN50	2.375 60.3	365 2517	1617 7192	0.12 3.048	1	⅜ x 2 ¼ M10 x 57	2.32 59	2.85 72	3.76 96	1.98 50	2.29 58	2.95 75	3.45 88	1.98 50	1.9 0.9
2 ½	2.875 73.0	365 2517	2370 10540	0.12 3.048	1	⅜ x 2 ¼ M10 x 57	2.63 67	3.09 78	4.29 109	1.99 51	2.61 66	3.15 80	3.93 100	1.99 51	2.1 1.0
DN65	3.000 76.1	365 2517	2580 11476	0.12 3.048	1	7/16 x 2 ¾ M11 x 69	2.68 68	3.22 82	4.56 116	2.03 52	2.64 67	3.45 88	4.22 107	2.03 52	2.4 1.1
3 DN80	3.500 88.9	365 2517	3512 15620	0.12 3.048	1	7/16 x 2 ¾ M11 x 69	2.93 74	3.53 90	5.13 130	2.07 53	2.89 73	3.78 96	4.67 119	2.07 53	2.7 1.2
4 DN100	4.500 114.3	300 2068	4771 21223	0.17 4.318	1	7/16 x 2 ¾ M11 x 69	3.47 88	4.01 102	6.03 153	2.08 53	3.43 87	4.22 107	5.56 141	2.08 53	3.5 1.6

4 Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. See the Listings/Approvals section of this publication for ratings on other pipe.

5 The allowable pipe separation dimension shown is for system layout purposes only. Style 109 couplings are considered rigid connections and will not accommodate expansion or contraction of the piping system.

NOTES

- When assembling Style 009V, Style 009N or Style 109 couplings onto end caps, take additional care to make certain the end cap is fully seated against the gasket end stop. For Style 009V, Style 009N couplings, use FireLock No. 006 end caps containing the “EZ” marking on the inside face or No. 60 end caps containing the “QV EZ” marking on the inside face. Non-Victaulic end cap products shall not be used with Style 009V, Style 009N or Style 109 couplings. IMPORTANT: Gaskets intended for the Style 009 or Style 009V couplings cannot be used with the Style 009N or Style 109 coupling. There is no interchanging of gaskets or housings between coupling styles.
- **Use Of FlushSeal Gaskets For Dry Pipe Systems** Style 009V, Style 009N or Style 109 couplings are supplied with Grade “E” Type A gaskets. These gaskets include an integral pipe stop, that once installed provides the similar benefits as a FlushSeal gasket for dry pipe systems. It should be noted that standard Victaulic FlushSeal gaskets cannot be used with the Style 009V, Style 009N or Style 109 couplings.
- The Allowable Pipe End Separation dimension shown is for system layout purposes only. Style 009V, Style 009N or Style 109 Installation-Ready rigid couplings are considered rigid connections and will not accommodate expansion/contraction or angular movement of the piping system. Contact Victaulic for torsional resistance information.

5.0 PERFORMANCE

Style 009V Two-Bolt Installation-Ready Coupling Listings/Approvals

Size		cULus		FM	
Nominal inches DN	Actual Outside Diameter inches mm	Sch. 10 psi kPa bar	Sch. 40 psi kPa bar	Sch. 10 psi kPa bar	Sch. 40 psi kPa bar
1 ¼ DN32	1.660 42.4	365 2516 25	365 2516 25	365 2515 25	365 2515 25
1 ½ DN40	1.900 48.3	365 2516 25	365 2516 25	365 2515 25	365 2515 25
2 DN50	2.375 60.3	365 2516 25	365 2516 25	365 2515 25	365 2515 25
2 ½	2.875 73.0	365 2516 25	365 2516 25	365 2515 25	365 2515 25
3 DN80	3.500 88.9	365 2516 25	365 2516 25	365 2515 25	365 2515 25
4 DN100	4.500 114.3	365 2516 25	365 2516 25	365 2515 25	365 2515 25
6 DN150	6.625 168.3	300 2068 20	365 2516 25	300 2065 20	365 2515 25
8 DN200	8.625 219.1	300[14] 2068[14] 20[14]	365 2516 25	300[13] 2065[13] 20[13]	365 2515 25
10 DN250	10.750 273.0	300[14] 2068[14] 20[14]	365 2516 25	300[13] 2065[13] 20[13]	365 2515 25
12 DN300	12.750 323.9	300[14] 2068[14] 20[14]	365 2516 25	300[13] 2065[13] 20[13]	365 2515 25

6 Listed/Approved for continuous use in wet and dry systems. Listed/Approved for dry systems -40° F/C and above. Please see the Victaulic InstallationManual I-009V for details concerning when supplemental lubrication is required.

8 FM approved for BS 1387 (EN 10255) Medium 3.6 mm pipe wall.

9 cULus listed for EN 10220 4.0 mm pipe wall.

10 cULus listed for EN 10255 4.5 mm pipe wall.

13 FM approved for 0.188” pipe wall.

14 cULus listed for 0.188” pipe wall.

15 cULus listed for JIS G3452 5.8mm pipe wall.

5.1 PERFORMANCE

Specialty Pipe
Style 009V Two-Bolt Installation-Ready Coupling Listings/Approvals

Pipe Type	Size	Pressure Rating	Pressure Rating
	inches DN	UL psi kPa bar	FM psi kPa bar
EF	1 ¼ – 4 DN32 – DN100	300 2068 20	300 2065 20
EL	1 ¼ – 2 DN32 – DN50	–	300 2065 20
MF	1 ¼ – 6 DN32 – DN150	300 2068 20	300 2065 20
FF	1 ½ – 4 DN40 – DN100	300 2068 20	300 2065 20
HF	1 ¼ – 4 DN32 – DN100	–	300 2065 20
	2 – 4 DN50 – DN100	300 2068 20	– – –
ET40	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2065 20
EZT	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2065 20
MT	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2065 20
MLT	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2065 20
Easy-Flow	1 ¼ – 4 DN32 – DN100	175 1206 12	300 2065 20
WG5, WG5E, WF5, WL7	1 ¼ – 4 DN32 – DN100	175 1206 12	–
WG7, WG7E	1 ¼ – 4 DN32 – DN100	175 1206 12	300 2065 20
WLS	1 ¼ – 2 DN32 – DN50	–	300 2065 20
GL	1 ¼ – 2 DN32 – DN50	–	300 2065 20

NOTES

- Easy Flow = Steel pipe manufactured by Borusan Mannesmann Boru
- EF = EDDY FLOW steel pipe manufactured by Bull Moose Tube Co.
- EL = EDDYLITE steel pipe manufactured by Bull Moose Tube Co.
- ET40 = Eddythread 40 steel pipe manufactured by Bull Moose Tube Co.
- EZF = EZ-Flow steel pipe manufactured by Northwest Pipe Co.
- EZT = EZ-Thread steel pipe manufactured by Youngstown Tube Co.
- FF = Fire-Flo steel pipe manufactured by Youngstown Tube Co.
- GL = GL steel pipe manufactured by Wheatland Tube Co.
- HF = Hydroflow sch 7 steel pipe manufactured by Nucor Tubular Products Inc.
- MF = Mega-Flow steel pipe manufactured by Wheatland Tube Co.
- MT = Mega-Thread steel pipe manufactured by Wheatland Tube Co.
- MLT = MLT steel pipe manufactured by Wheatland Tube Co
- WG5, WG5E, WF5 = WGalweld 5, WGalweld 5E, WFlow 5 steel pipe manufactured by Wuppermann Stahl GmbH.
- WG7, WG7E, WL7 = WGalweld 7, Wgalweld 7E, WLight 7 steel pipe manufactured by Wuppermann Stahl GmbH
- WLS = WLS steel pipe manufactured by Wheatland Tube Co.

5.2 PERFORMANCE

Style 009N Two-Bolt *Installation-Ready* Coupling Listings/Approvals[6]

The information provided below is based on the latest listing and approval data at the time of publication. Listings/Approvals are subject to change and/or additions by the approval agencies. Contact Victaulic for performance on other pipe and the latest listings and approvals.

Size		cULus		FM		VdS	LPCB
Nominal inches DN	Actual Outside Diameter inches mm	Sch. 10 psi kPa bar	Sch. 40 psi kPa bar	Sch. 10 psi kPa bar	Sch. 40 psi kPa bar	psi kPa bar	psi kPa bar
1 ¼ DN32	1.660 42.4	365 2516 25	365 2516 25	363 2503 25	363 2503 25	363 2503 25	363 2503 25
1 ½ DN40	1.900 48.3	365 2516 25	365 2516 25	363 2503 25	363 2503 25	363 2503 25	363 2503 25
2 DN50	2.375 60.3	365 2516 25	365 2516 25	363 2503 25	363 2503 25	363 2503 25	363 2503 25
2 ½	2.875 73.0	365 2516 25	365 2516 25	363 2503 25	363 2503 25	–	363 2503 25
DN65	3.000 76.1	365[7] 2516[7] 25[7]	–	363[8] 2503[8] 25[8]	–	363 2503 25	363 2503 25
3 DN80	3.500 88.9	365 2516 25	365 2516 25	363 2503 25	363 2503 25	363 2503 25	363 2503 25
4 DN100	4.500 114.3	365 2516 25	365 2516 25	363 2503 25	363 2503 25	363 2503 25	363 2503 25
	4.250 108.0	–	–	363 2503 25	363 2503 25	–	–
5	5.563 141.3	365 2516 25	365 2516 25	363 2503 25	363 2503 25	232 1600 16	363 2503 25
	5.250 133.0	–	–	363[8] 2503[8] 25[8]	–	–	–
DN125	5.500 139.7	290[9] 1999[9] 20[9]	–	363[8] 2503[8] 25[8]	–	232 1600 16	363 2503 25
6 DN150	6.625 168.3	300 2068 20	365 2516 25	300 2068 20	363 2503 25	232 1600 16	363 2503 25
	6.250 159	–	–	363[8] 2503[8] 25[8]	–	–	–

6 Listed/Approved for continuous use in wet and dry systems. Listed/Approved for dry systems -40° F/C and above.
Please see the Victaulic InstallationManual I-109 for details concerning when supplemental lubrication is required.

7 cULus listed for DIN 2458 (EN 10220) 2.6 mm pipe wall.

8 FM approved for BS 1387 (EN 10255) Medium 3.6 mm pipe wall.

9 cULus listed for EN 10220 4.0 mm pipe wall.

10 cULus listed for EN 10255 4.5 mm pipe wall.

11 With optional stainless steel fasteners, cULus Listed to 175psi/1207 kPa/12 bar and FM Approved to the FM ratings shown in the above table. The stainless steel fasteners have a marking designation of "316" on the end face of the bolt.

12 cUL listed to 250 psi/1720 kPa /17 bar.

13 FM approved for 0.188" pipe wall.

14 cULus listed for 0.188" pipe wall.

15 cULus Listed for JIS G3452 pipe.

5.2 PERFORMANCE (CONTINUED)

Style 009N Two-Bolt *Installation-Ready* Coupling Listings/Approvals[6]

The information provided below is based on the latest listing and approval data at the time of publication. Listings/Approvals are subject to change and/or additions by the approval agencies. Contact Victaulic for performance on other pipe and the latest listings and approvals.

Size		cULus		FM		VdS	LPCB
Nominal inches DN	Actual Outside Diameter inches mm	Sch. 10 psi kPa bar	Sch. 40 psi kPa bar	Sch. 10 psi kPa bar	Sch. 40 psi kPa bar	psi kPa bar	psi kPa bar
	6.500 165.1	290[10] 1999[10] 20[10]	–	363[8] 2503[8] 25[8]	–	–	363 2503 25
8 DN200	8.625 219.1	300[14] 2068[14] 20[14]	365 2516 25	300[13] 2068[13] 20[13]	363 2503 25	232 1600 16	363 2503 25
	8.515 216.3	290 1999 20	–	363[8] 2503[8] 25[8]	–	–	–
10 DN250	10.750 273.0	300[14] 2068[14] 20[14]	300 2068 20	300[13] 2068[13] 20[13]	300 2068 20	–	290 2000 20
12 DN300	12.750 323.9	300[12 14] 2068[12 14] 20[12 14]	300 2068 20	250[13] 1720[13] 17[13]	300 2068 20	–	290 2000 20

6 Listed/Approved for continuous use in wet and dry systems. Listed/Approved for dry systems -40° F/C and above. Please see the Victaulic InstallationManual I-109 for details concerning when supplemental lubrication is required.

7 cULus listed for DIN 2458 (EN 10220) 2.6 mm pipe wall.

8 FM approved for BS 1387 (EN 10255) Medium 3.6 mm pipe wall.

9 cULus listed for EN 10220 4.0 mm pipe wall.

10 cULus listed for EN 10255 4.5 mm pipe wall.

11 With optional stainless steel fasteners, cULus Listed to 175psi/1207 kPa/12 bar and FM Approved to the FM ratings shown in the above table. The stainless steel fasteners have a marking designation of "316" on the end face of the bolt.

12 cUL listed to 250 psi/1720 kPa /17 bar.

13 FM approved for 0.188” pipe wall.

14 cULus listed for 0.188” pipe wall.

15 cULus Listed for JIS G3452 pipe.

5.3 PERFORMANCE

Specialty Pipe
Style 009N Two-Bolt *Installation-Ready* Coupling Listings/Approvals

Pipe Type	Size	Pressure Rating	
	inches DN	UL psi kPa bar	FM psi kPa bar
EF	1 ¼ – 4 DN32 – DN100	300 2068 20	–
EL	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2068 20
EZF	3-4 DN80 – DN100	300 2068 20	–
MF	1 ¼ – 4 DN32 – DN100	300 2068 20	300 2068 20
	6 DN150	175 1206 12	175 1207 12
FF	1 ½ – 4 DN40 – DN100	300 2068 20	–
ET40	1 ¼ – 2 DN32 – DN50	300 2068 20	–
EZT	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2068 20
MT	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2068 20
MLT	1 ¼ – 2 DN32 – DN50	–	300 2068 20
Easy Flow	1 ¼ – 4 DN32 – DN100	–	300 2068 20
WG5, WG5E, WF5, WG7, WG7E,WL7	1 ¼ – 4 DN32 – DN100	300 2068 24	300 2068 20
TF (Tex-Flow)	2 ½ – 4 DN65 - DN100	–	300 2068 20
WLS	1 ¼ – 2 DN32 – DN50	–	300 2068 20
GL	1 ¼ – 2 DN32 – DN50	–	300 2068 20

NOTES

- Easy Flow = Steel pipe manufactured by Borusan Mannesmann Boru
- EF = EDDY FLOW steel pipe manufactured by Bull Moose Tube Co.
- EL = EDDYLITE steel pipe manufactured by Bull Moose Tube Co.
- ET40 = Eddythread 40 steel pipe manufactured by Bull Moose Tube Co.
- EZF = EZ-Flow steel pipe manufactured by Northwest Pipe Co.
- EZT = EZ-Thread steel pipe manufactured by Youngstown Tube Co.
- FF = Fire-Flo steel pipe manufactured by Youngstown Tube Co.
- GL = GL steel pipe manufactured by Wheatland Tube Co.
- MF = Mega-Flow steel pipe manufactured by Wheatland Tube Co.
- MT = Mega-Thread steel pipe manufactured by Wheatland Tube Co.
- MLT = MLT steel pipe manufactured by Wheatland Tube Co
- TF = Tex-Flow steel pipe manufactured by Tex-Tube Co.
- WG5, WG5E, WF5 = WGalweld 5, WGalweld 5E, WFlow 5 steel pipe manufactured by Wuppermann Stahl GmbH.
- WG7, WG7E, WL7 = WGalweld 7, Wgalweld 7E, WLight 7 steel pipe manufactured by Wuppermann Stahl GmbH
- WLS = WLS steel pipe manufactured by Wheatland Tube Co.

5.4 PERFORMANCE

Style 109 One-Bolt *Installation-Ready* Coupling Listings/Approvals[15]

The information provided below is based on the latest listing and approval data at the time of publication. Listings/ Approvals are subject to change and/or additions by the approvals agencies. Contact Victaulic for performance on other pipe and the latest listings and approvals.

Size		cULus		FM		VdS	LPCB
Nominal inches DN	**Actual Outside Diameter** inches mm	**Sch. 10** psi kPa bar	**Sch. 40** psi kPa bar	**Sch. 10** psi kPa bar	**Sch. 40** psi kPa bar	psi kPa bar	psi kPa bar
1 ¼ DN32	1.660 42.4	365 2516 25	365 2516 25	365 2517 25	365 2517 25	232 1600 16	363 2503 25
1 ½ DN40	1.900 48.3	365 2516 25	365 2516 25	365 2517 25	365 2517 25	232 1600 16	363 2503 25
2 DN50	2.375 60.3	365 2516 25	365 2516 25	365 2517 25	365 2517 25	232 1600 16	363 2503 25
2 ½	2.875 73.0	365 2516 25	365 2516 25	365 2517 25	365 2517 25	–	–
DN65	3.000 76.1	–	–	365 2517 25	365 2517 25	232 1600 16	363 2503 25
3 DN80	3.500 88.9	365 2516 25	365 2516 25	365 2517 25	365 2517 25	232 1600 16	363 2503 25
4 DN100	4.500 114.3	300 2068 20	300 2068 20	300 2068 20	300 2068 20	–	290 2000 20

15 Listed/Approved for continuous use in wet and dry systems. Listed/Approved for dry systems -40° F/C and above. Please see the Victaulic Installation Manual I-109 for details concerning when supplemental lubrication is required.

NOTE

- With optional stainless steel fasteners, cULus Listed to 300 psi/2068 kPa/20.6 bar and FM Approved to the FM ratings shown in the above table. The stainless steel fasteners have a marking designation of "316" on the head of the bolt.

5.5 PERFORMANCE

Specialty Pipe
Style 109 One-Bolt *Installation-Ready* Coupling Listings/Approvals

Pipe Type	Size inches DN	Pressure Rating cULus psi kPa bar	Pressure Rating FM psi kPa bar
EF	1 ¼ – 2½ DN32 – 73.0 mm	–	300 2068 20
	1 ½ – 2½ DN40 – 73.0 mm	300 2068 20	–
	3 – 4 DN80 – DN100	300 2068 20	300 2068 20
Easy Flow	1 ¼ – 2 DN32 – DN50	–	300 2068 20
	3 – 4 DN80 – DN100	–	300 2068 20
EL	1 ¼ – 2 DN32 – DN50	–	300 2068 20
ET40	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2068 20
EZT	1 ¼ – 2 DN32 – DN50	–	300 2068 20
	1 ½ – 2 DN40 – DN50	300 2068 20	–
FF	1 ½ – 4 DN40 – DN100	300 2068 20	300 2068 20
GL	1 ¼ – 2 DN32 – DN50	–	300 2068
MF	1 ¼ – 4 DN32 – DN100	300 2068 20	300 2068 20
MT	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2068 20
MLT	1 ¼ – 2 DN32 – DN50	300 2068 20	300 2068 20

NOTES

- EF = EDDY FLOW steel pipe manufactured by Bull Moose Tube Co.
- Easy Flow = Easy Flow steel pipe manufactured by Borusan Mannesmann Boru.
- EL = EDDYLITE steel pipe manufactured by Bull Moose Tube Co.
- ET40 = Eddythread 40 steel pipe manufactured by Bull Moose Tube Co.
- EZT = EZ-Thread steel pipe manufactured by Youngstown Tube Co.
- FF = Fire-Flo steel pipe manufactured by Youngstown Tube Co.
- GL = GL steel pipe manufactured by Wheatland Tube Co.
- MF = Mega-Flow steel pipe manufactured by Wheatland Tube Co.
- MT = Mega-Thread steel pipe manufactured by Wheatland Tube Co.
- MLT = MLT steel pipe manufactured by Wheatland Tube Co.
- TF = Tex-Flow steel pipe manufactured by Tex-Tube Co.
- WG5, WG5E, WF5 = WGalweld 5, WGalweld 5E, and WFlow 5 steel pipe manufactured by Wuppermann Stahl GmbH
- WG7, WG7E, WL7 = WGalweld 7, WGalweld 7E, and WLight 7 steel pipe manufactured by Wuppermann Stahl GmbH.
- WLS = WLS steel pipe manufactured by Wheatland Tube Co.

5.5 PERFORMANCE (CONTINUED)

Specialty Pipe
Style 109 One-Bolt *Installation-Ready* Coupling Listings/Approvals

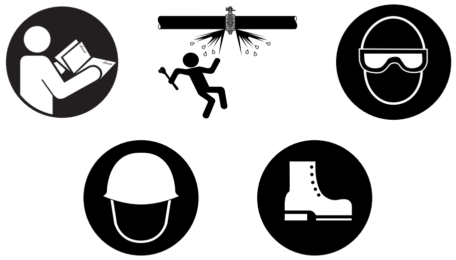
Pipe Type	Size	Pressure Rating	
	inches DN	cULus psi kPa bar	FM psi kPa bar
TF	2½ – 4 73.00 mm – DN100	–	300 2068 20
WG5, WG5E, WF5, WL7	1¼ – 4 DN32 – DN100	300 2068 20	–
WG7, WG7E	1¼ – 4 DN32 – DN100	300 2068 20	300 2068 20
WLS	1¼ – 2 DN32 – DN50	–	300 2068 20

NOTES

- EF = EDDY FLOW steel pipe manufactured by Bull Moose Tube Co.
- Easy Flow = Easy Flow steel pipe manufactured by Borusan Mannesmann Boru.
- EL = EDDYLITE steel pipe manufactured by Bull Moose Tube Co.
- ET40 = Eddythread 40 steel pipe manufactured by Bull Moose Tube Co.
- EZT = EZ-Thread steel pipe manufactured by Youngstown Tube Co.
- FF = Fire-Flo steel pipe manufactured by Youngstown Tube Co.
- GL = GL steel pipe manufactured by Wheatland Tube Co.
- MF = Mega-Flow steel pipe manufactured by Wheatland Tube Co.
- MT = Mega-Thread steel pipe manufactured by Wheatland Tube Co.
- MLT = MLT steel pipe manufactured by Wheatland Tube Co.
- TF = Tex-Flow steel pipe manufactured by Tex-Tube Co.
- WG5, WG5E, WF5 = WGalweld 5, WGalweld 5E, and WFlow 5 steel pipe manufactured by Wuppermann Stahl GmbH
- WG7, WG7E, WL7 = WGalweld 7, WGalweld 7E, and WLight 7 steel pipe manufactured by Wuppermann Stahl GmbH.
- WLS = WLS steel pipe manufactured by Wheatland Tube Co.

6.0 NOTIFICATIONS

⚠ WARNING



- **Read and understand all instructions before attempting to install any Victaulic products.**
- **Always verify that the piping system has been completely depressurized and drained immediately prior to installation, removal, adjustment, or maintenance of any Victaulic products.**
- **Wear safety glasses, hardhat, and foot protection.**

Failure to follow these instructions could result in death or serious personal injury and property damage.

- **These products shall be used only in fire protection systems that are designed and installed in accordance with current, applicable National Fire Protection Association (NFPA 13, 13D, 13R, etc.) standards, or equivalent standards, and in accordance with applicable building and fire codes. These standards and codes contain important information regarding protection of systems from freezing temperatures, corrosion, mechanical damage, etc.**
- **The installer shall understand the use of this product and why it was specified for the particular application.**
- **The installer shall understand common industry safety standards and potential consequences of improper product installation.**
- **It is the system designer's responsibility to verify suitability of materials for use with the intended fluid media within the piping system and external environment.**
- **The material specifier shall evaluate the effect of chemical composition, pH level, operating temperature, chloride level, oxygen level, and flow rate on materials to confirm system life will be acceptable for the intended service.**

Failure to follow installation requirements and local and national codes and standards could compromise system integrity or cause system failure, resulting in death or serious personal injury and property damage.

NOTICE

- **Victaulic does not recommend the use of any furnace butt-welded pipe with sizes 2"/DN50 and smaller Victaulic gasketed joint products. This includes, but is not limited to, ASTM A53 Type F pipe.**

NOTE

- If using coated pipe, please refer to the installation instructions for pipe preparation details.

7.0 REFERENCE MATERIALS

05.01: Seal Selection Guide

25.01: Original Groove System (OGS) Groove Specifications

I-009N: Installation Instructions FireLock EZ™ Rigid Coupling Style 009N

I-009V: Installation Instructions FireLock™ Installation-Ready™ Rigid Coupling Style 009V

I-100: Victaulic Field Installation Handbook

I-109: Installation Instructions FireLock™ One-Bolt Rigid Coupling Style 109

I-ENDCAP: Victaulic End Caps Installation Instructions

I-IMPACT: Impact Tool Usage Guidelines

FireLock™ Installation-Ready™ Flexible Coupling Style 004N

2 – 8"/DN50 – DN200

1.0 PRODUCT DESCRIPTION

Available Sizes

- 2 – 8"/DN50 – DN200

Pipe Material

- Carbon steel
- For exceptions reference section 6.0 Notifications.

Maximum Working Pressure

- Accommodates pressures ranging from full vacuum (29.9 in Hg/760 mm Hg) up to 365 psi/2520 kPa.
- Working pressure dependent on material, wall thickness and size of pipe.

Function

- Joins roll or cut grooved pipe, grooved fittings, valves, and accessories.
- Provides a flexible pipe joint designed to accommodate a limited amount of linear and/or angular movement.

Pipe Preparation

- Cut or roll grooved in accordance with publication 25.01: Victaulic Standard Groove Specifications.

2.0 CERTIFICATION/LISTINGS

c UL us LISTED   FM APPROVED

NOTE

- See publication 10.01: Victaulic Products for Fire Protection Piping Systems - Regulatory Approval Reference Guide for details.

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

3.0 SPECIFICATIONS – MATERIAL

Housing: Ductile iron conforming to ASTM A536, Grade 65-45-12. Ductile iron conforming to ASTM A395, Grade 65-45-15 available upon special request.

Housing Coating: (specify choice)

- ☐ Standard: Orange enamel.
- ☐ Optional: Contact Victaulic with your requirements for other coatings.

Gasket: Grade "E" EPDM (Type A) Vic-Plus™ Pre-lubricated Gasket

EPDM (Violet Color Code). Applicable for wet and dry (oil-free air) fire protection systems only. Listed/Approved for continuous use in wet and dry systems. Listed/Approved for dry systems at –40°F/–40°C and above. Not compatible for use with hot water services or steam services.

NOTES

- Victaulic reserves the right to substitute equivalent and/or higher grade elastomer products.
- Services listed are General Service Guidelines only. It should be noted that there are services for which these gaskets are not compatible. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service guidelines and for a listing of services which are not compatible.
- Reference should always be made to publication I-100, Victaulic Field Installation Handbook for gasket lubrication instructions.

Bolts/Nuts: (specify choice)

- ☐ Standard: Carbon steel oval neck track bolts meeting the mechanical property requirements of ASTM A449 (imperial) and ISO 898-1 Class 9.8 (M10-M16) Class 8.8 (M20 and greater). Carbon steel hex nuts meeting the mechanical property requirements of ASTM A563 Grade B (imperial – heavy hex nuts) and ASTM A563M Class 9 (metric – hex nuts). Track bolts and hex nuts are zinc electroplated per ASTM B633 ZN/FE5, finish Type III (imperial) or Type II (metric).

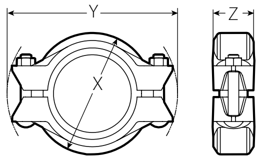
4.0 DIMENSIONS

Style 004N

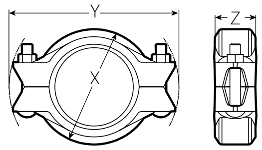
Dimensions for Determining Piping System Installation Clearances

Data in the below table is provided for system layout and installation purposes to ensure that adequate clearances are included in the piping system installation relative to other piping components or the building structure for both roll grooved and cut grooved pipe.

This is particularly important when the system is free floating, or contains no thrust anchors, and the coupling joints are installed with the pipe ends butted against the gasket[2]. If installed in this condition, when the piping is pressurized the joints will open to their full nominal pipe end separation[3]. This movement is cumulative and will be most significant in long runs of piping where multiple flexible couplings are installed in the butted condition.



Pre-Assembled
(Installation-Ready™ Condition)



Joint Assembled

Size		Nominal Range of Pipe End Separation[1]				Bolt/Nut		Dimensions					Weight
								Pre-Assembled (Installation-Ready™ Condition)		Joint Assembled			
Nominal inches DN	Actual Outside Diameter inches mm	Pipe Ends Butted Against Gasket[2] inches mm	Full Nominal Separation[3] inches mm	Maximum Working Pressure[4] psi kPa	Maximum End Load[4] lbs N	Qty.	Size inches mm	X inches mm	Y inches mm	X inches mm	Y inches mm	Z inches mm	Approximate (Each) lb kg
2 DN50	2.375 60.3	0.13 3.3	0.25 6.4	365 2520	1617 7190	2	½ x 3 M12 x 76	4.38 111	6.25 159	3.75 95	6.38 162	2.13 54	3.3 1.5
2 ½	2.875 73.0	0.13 3.3	0.25 6.4	365 2520	2370 10540	2	½ x 3 M12 x 76	4.88 124	6.88 175	4.38 111	6.88 175	2.13 54	3.8 1.7
3 DN80	3.500 88.9	0.13 3.3	0.25 6.4	365 2520	3512 15620	2	½ x 3 ¼ M12 x 83	5.63 143	7.38 187	5.00 127	7.50 191	2.13 54	4.3 2.0
4 DN100	4.500 114.3	0.18 4.6	0.38 9.5	365 2520	5805 25820	2	⅝ x 4 M16 x 101	7.13 181	9.38 238	6.38 162	9.50 241	2.38 60	7.4 3.4
5	5.5625 141.3	0.18 4.6	0.38 9.5	365 2520	8872 39460	2	¾ x 5 M20 x 127	8.03 204	11.03 280	7.31 186	11.32 288	2.25 57	10 4.5
6 DN150	6.625 168.3	0.18 4.6	0.38 9.5	365 2520	12582 55970	2	¾ x 5 M20 x 127	9.38 238	12.38 314	8.63 219	12.25 311	2.38 60	12.8 5.8
8 DN200	8.625 219.1	0.18 4.6	0.38 9.5	365 2520	21326 94860	2	⅞ x 5 ½ M22 x 139	11.00 279	15.13 384	10.00 254	15.13 384	2.63 67	20.7 9.4

1 These columns provide the nominal range of pipe end separation that may exist at the time of installation.

2 The nominal pipe end separation when the pipe ends are butted against the gasket as illustrated in Figure 1.

3 The full nominal pipe end separation when the pipe ends are separated fully as illustrated in Figure 2.

4 Working pressure and End Load are total, from all internal and external loads, based on (ANSI) steel pipe, grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

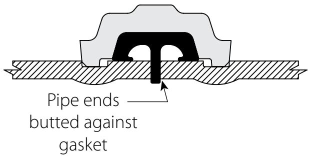


Figure 1

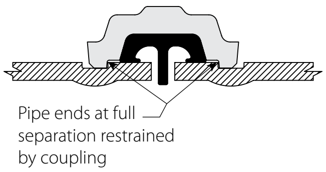


Figure 2

4.1 DIMENSIONS

Style 004N

Design and Installation – Linear Movement and Angular Deflection

Data in the table below provides the linear movement and joint deflection capabilities of each coupling. These mechanical properties of the flexible coupling can be used in the design of the piping system to accommodate curves in the piping system, settlement of the building structure, seismic movement, or thermally induced expansion or contraction of the piping.

The linear movement[6] can be used to accommodate any axial movement of the piping caused by thermally induced expansion or contraction of the pipe. When used in this manner, thrust anchors must be installed at changes in direction, at the ends of straight runs, or to divide long runs of pipe into more manageable sections and reduce movement at branch connections. Reference should be made to Victaulic publication 26.02 for detailed instructions regarding determining thrust anchor or guide locations.

The joint deflection[7,8] can also be used to accommodate the axial change in length of the piping caused by thermally induced expansion or contraction of the piping through the controlled deflection of offsets at existing changes in direction of the piping. Again, refer to Victaulic publication 26.02 for detailed instructions.

Size		Linear Movement per Coupling[5,8]	Joint Deflection[8]	
Range inches DN	Actual Outside Diameter inches mm	inches mm	Angle at Coupling[6] Degrees per coupling	Slope of Pipe[7] in/ft mm/m
2 DN50	2.375 60.3	0.09 2.3	2.17	0.46 38.1
2½	2.875 73.0	0.09 2.3	1.79	0.38 31.5
3 DN80	3.500 88.9	0.09 2.3	1.47	0.31 25.9
4 DN100	4.500 114.3	0.18 4.6	2.29	0.48 40.3
5	5.5625 141.3	0.18 4.6	1.85	0.39 32.4
6 DN150	6.625 168.3	0.18 4.6	1.56	0.33 27.3
8 DN200	8.625 219.1	0.18 4.6	1.20	0.25 21.0

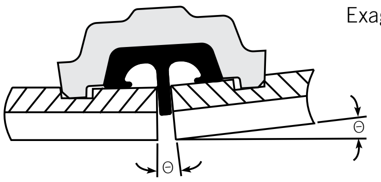
5 This is the actual net linear movement available at each coupling for design purposes as illustrated in Figures 1 and 2.

6 This is the actual net deflection angle available at each coupling listed in degrees as illustrated in Figure 3.

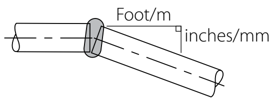
7 This is the actual net deflection angle available at each coupling listed as a slope of the pipe as illustrated in Figure 4.

8 These values are the net amount of linear movement or joint deflection available at the couplings. No further reduction, as detailed in Victaulic publication 26.02, is needed to allow for design and installation purposes.

Exaggerated for clarity



Deflection Angle at Each Coupling Listed in Degrees
Figure 3



Deflection Angle at Each Coupling Listed as a Slope of the Pipe
Figure 4

NOTE

- A coupling joint cannot provide the full linear movement and full angular deflection at the same time. If both linear movement and angular deflection are needed, sufficient couplings must be installed for each purpose. Refer to Victaulic publication 26. 02 for complete details.

5.0 PERFORMANCE

Style 004N

Size		cULus		FM	
Nominal inches DN	**Actual Outside Diameter** inches mm	**Schedule 10** psi kPa	**Schedule 40** psi kPa	**Schedule 10** psi kPa	**Schedule 40** psi kPa
2 DN50	2.375 60.3	365 2520	365 2520	365 2520	365 2520
2½	2.875 73.0	365 2520	365 2520	365 2520	365 2520
3 DN80	3.500 88.9	365 2520	365 2520	365 2520	365 2520
4 DN100	4.500 114.3	365 2520	365 2520	365 2520	365 2520
5	5.563 141.3	365 2520	365 2520	365 2520	365 2520
6 DN150	6.625 168.3	365 2520	365 2520	365 2520	365 2520
8 DN200	8.625 219.1	365[9] 2520	365 2520	365[9] 2520	365 2520

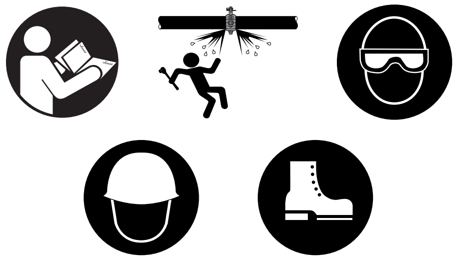
[9] UL listed and FM approved for .188" wall thickness.

NOTES

- WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1½ times the figures shown.
- Depressurize and drain the piping system before attempting to install, remove or adjust any Victaulic piping products.

6.0 NOTIFICATIONS

WARNING



- Read and understand all instructions before attempting to install any Victaulic products.
- Always verify that the piping system has been completely depressurized and drained immediately prior to installation, removal, adjustment, or maintenance of any Victaulic products.
- Wear safety glasses, hardhat, and foot protection.

Failure to follow these instructions could result in death or serious personal injury and property damage.

- These products shall be used only in fire protection systems that are designed and installed in accordance with current, applicable National Fire Protection Association (NFPA 13, 13D, 13R, etc.) standards, or equivalent standards, and in accordance with applicable building and fire codes. These standards and codes contain important information regarding protection of systems from freezing temperatures, corrosion, mechanical damage, etc.
- The installer shall understand the use of this product and why it was specified for the particular application.
- The installer shall understand common industry safety standards and potential consequences of improper product installation.
- It is the system designer's responsibility to verify suitability of materials for use with the intended fluid media within the piping system and external environment.
- The material specifier shall evaluate the effect of chemical composition, pH level, operating temperature, chloride level, oxygen level, and flow rate on materials to confirm system life will be acceptable for the intended service.

Failure to follow installation requirements and local and national codes and standards could compromise system integrity or cause system failure, resulting in death or serious personal injury and property damage.

WARNING

- When assembling Style 004N Couplings onto end caps, take additional time to inspect and verify that the end cap is seated fully against the center leg of the gasket. Always read and follow the installation instructions provided with the product; these instructions can be downloaded at Victaulic.com.
- Use only Victaulic End Caps containing the “QV” or “EZ QV” marking on the inside face.
- Always read and follow the I-ENDCAP, Victaulic End Cap Installation Safety Instructions, which can be downloaded at Victaulic.com.
- Victaulic recommends the use of Victaulic fittings with Style 004N Couplings.

Failure to follow these instructions could result in death or serious personal injury and property damage.

NOTICE

- Victaulic does not recommend the use of any furnace butt-welded pipe with sizes NPS 2”/DN50 and smaller Victaulic gasketed joint products. This includes, but is not limited to, ASTM A53 Type F pipe.

7.0 REFERENCE MATERIALS

05.01: Victaulic Seal Selection Guide

10.01: Victaulic Fire Protection Certifications/Listings Reference Guide

26.01: Victaulic Design Data

29.01: Victaulic Terms and Conditions/Warranty

AN-001: Application Notification - Potential Incompatibility of Type F Pipe, Sizes NPS 2" | DN50 and Smaller

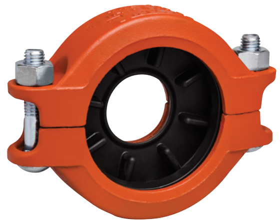
I-004N: Style 004N FireLock™ Installation-Ready™ Flexible Coupling Installation Instructions

I-100: Victaulic Field Installation Handbook

I-ENDCAP: Victaulic End Caps Installation Instructions

I-IMPACT: Victaulic Impact Tool Usage Guidelines

Victaulic® Reducing Coupling
Style 750



1.0 PRODUCT DESCRIPTION

Available Sizes

- 2 x 1" through 10 x 8"/DN50 x DN25 through DN250 x DN200

Pipe Material

- Carbon steel
- For exceptions reference section 6.0 Notifications

NOTE
- For other pipe materials, contact Victaulic.

Maximum Working Pressure

- 500 psi/3447 kPa
- Working pressure dependent on material, wall thickness and size of pipe

Application

- Joins Original Groove System (OGS) roll grooved and cut grooved pipe, as well as OGS grooved fittings, valves and accessories
- Permits direct reduction on piping run
- Optional steel washer prevents telescoping of the smaller pipe inside the larger pipe during vertical system assembly

Pipe Preparation

- Cut or roll grooved in accordance with publication 25.01: Victaulic Standard Groove Specifications.

2.0 CERTIFICATION/LISTINGS

EN 10311 CPR (EU) No. 305/2011	BS EN 10311 CPR (UK) 2019 No. 465

NOTE
- Download publication 10.01 for Fire Protection Certifications/Listings Reference Guide.

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

3.0 SPECIFICATIONS – MATERIAL

Housing: Ductile iron conforming to ASTM A536, Grade 65-45-12. Ductile iron conforming to ASTM A395, Grade 65-45-15, is available upon special request.

Housing Coating: (specify choice)

☐ Standard: Orange enamel.

☐ Optional: Hot dipped galvanized conforming to ASTM A153.

☐ Optional: Contact Victaulic with your requirements.

Gasket: (specify choice[1])

☐ **Grade "E" EPDM**

EPDM (Green stripe color code). Temperature range –30°F to +230°F/–34°C to +110°C. May be specified for hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL Classified in accordance with ANSI/NSF 61 for cold +73°F/+23°C and hot +180°F/+82°C potable water service and ANSI/NSF 372. **NOT COMPATIBLE FOR USE WITH PETROLEUM SERVICES OR STEAM SERVICES.**

☐ **Grade "T" Nitrile**

Nitrile (Orange stripe color code). Temperature range –20°F to +180°F/–29°C to +82°C. May be specified for oil related services, including air with oil vapor, this gasket may be specified for temperatures rated up to +180°F/+82°C. For water related services, this gasket may be specified for temperatures rated up to +150°F/+66°C. For oil free, dry air services, this gasket may be specified for temperatures rated up to +140°F/+60°C. **NOT COMPATIBLE FOR USE WITH HOT WATER SERVICES OR STEAM SERVICES.**

Others

☐ For alternate gasket selection, reference publication 05.01: Victaulic Seal Selection Guide.

1 Services listed are General Service Guidelines only. It should be noted that there are services for which these gaskets are not compatible. Reference should always be made to the latest Victaulic Seal Selection Guide for specific gasket service guidelines and for a listing of services which are not compatible.

Bolts/Nuts (specify choice[2]):

☐ Standard: Carbon steel oval neck track bolts meeting the mechanical property requirements of ASTM A449 (imperial) and ISO 898-1 Class 9.8 (M10-M16) Class 8.8 (M20 and greater). Carbon steel hex nuts meeting the mechanical property requirements of ASTM A563 Grade B (imperial – heavy hex nuts) and ASTM A563M Class 9 (metric – hex nuts). Track bolts and hex nuts are zinc electroplated per ASTM B633 ZN/FE5, finish Type III (imperial) or Type II (metric).

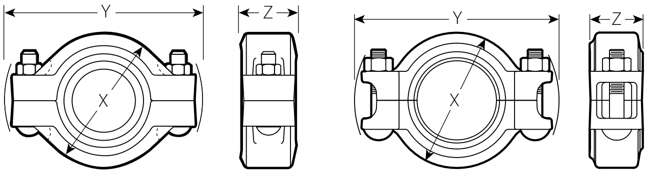
☐ Optional: Stainless steel oval neck track bolts meeting the mechanical property requirements of ASTM F593, Group 2 (316 stainless steel), condition CW. Stainless steel heavy nuts meeting the mechanical property requirements of ASTM F594, Group 2 (316 stainless steel), condition CW, with galling reducing coating.

Assembly Washer (optional): Galvanized carbon steel.

2 Optional bolts/nuts are available in imperial size only

4.0 DIMENSIONS

Style 750 Reducing Coupling



Size						Pipe End Separation[3]	Deflect. From CL[3]		Bolt/Nut		Dimensions			Weight
Nominal inches DN			Actual Outside Diameter inches mm			Allowable inches mm	Per Cplg. Degrees	Pipe in/ft mm/m	Qty.	Size inches mm	X inches mm	Y inches mm	Z inches mm	Approximate (Each) lb kg
2 DN50	x	1 DN25	2.375 60.3	x	1.315 33.7	0 - 0.07 0 - 1.8	0° - 57'	0.20 17	2	⅜ x 2	3.38 85	5.28 134	1.88 48	2.7 1.2
		1 ½ DN40			1.900 48.3	0 - 0.07 0 - 1.8	0° - 57'	0.20 17	2	⅜ x 2	3.38 85	5.28 134	1.88 48	2.0 1.0
2 ½	x	2 DN50	2.875 73.0	x	2.375 60.3	0 - 0.07 0 - 1.8	0° - 47'	0.16 14	2	⅜ x 2	4.00 102	5.93 151	1.88 48	3.1 1.4
DN65	x	2 DN50	3.000 76.1	x	2.375 60.3	0 - 0.07 0 - 1.8	0° - 47'	0.16 14	2	½ x 2 ¾	4.38 111	6.63 168	1.88 48	4.6 2.1
3 DN80	x	2 DN50	3.500 88.9	x	2.375 60.3	0 - 0.07 0 - 1.8	0° - 39'	0.13 11	2	½ x 2 ¾	4.75 121	7.13 181	1.88 48	4.9 2.2
		2 ½			2.875 73.0	0 - 0.07 0 - 1.8	0° - 39'	0.13 11	2	½ x 2 ¾	4.75 121	7.13 181	1.88 48	4.3 2.0
		DN65			3.00 76.1	0 - 0.07 0 - 1.8	0° - 39'	0.13 11	2	½ x 2 ¾	4.75 121	7.13 181	1.88 48	4.2 1.9
4 DN100	x	2 DN50	4.500 114.3	x	2.375 60.3	0 - 0.13 0 - 3.2	1° - 19'	0.28 25	2	⅝ x 3 ¼	6.25 159	8.90 226	2.25 57	8.1 3.7
		2 ½			2.875 73.0	0 - 0.13 0 - 3.2	1° - 19'	0.28 25	2	⅝ x 3 ¼	6.25 159	8.90 226	2.25 57	8.6 3.9
		DN65			3.000 76.1	0 - 0.13 0 - 3.2	1° - 19'	0.28 25	2	⅝ x 3 ¼	6.25 159	8.90 226	2.25 57	6.9 3.1
		3 DN80			3.500 88.9	0 - 0.13 0 - 3.2	1° - 19'	0.28 25	2	⅝ x 3 ¼	6.00 152	8.90 226	2.25 57	6.7 3.0
5	x	4 DN100	5.563 141.3	x	4.500 114.3	0 - 0.13 0 - 3.2	1° - 3'	0.22 19	2	¾ x 4 ¼	7.18 182	10.70 272	2.13 54	11.2 5.1
165.1	x	4 DN100	6.500 165.1	x	4.500 114.3	0 - 0.13 0 - 3.2	0° - 55'	0.19 16	2	¾ x 4 ¼	8.63 219	11.90 302	2.25 57	15.2 6.9
6 DN150	x	4 DN100	6.625 168.3	x	4.500 114.3	0 - 0.13 0 - 3.2	0° - 52'	0.18 15	2	¾ x 4 ¼	8.63 219	11.90 302	2.25 57	16.7 7.6
		5			5.563 141.3	0 - 0.13 0 - 3.2	0° - 52'	0.18 15	2	¾ x 4 ¼	8.31 211	11.90 302	2.25 57	12.9 5.9
8 DN200	x	165.1	8.625 219.1	x	6.500 165.1	0 - 0.13 0 - 3.2	0° - 38'	0.13 11	2	⅞ x 5	10.75 273	14.88 378	2.50 64	23.2 10.5
		6 DN150			6.625 168.3	0 - 0.13 0 - 3.2	0° - 38'	0.13 11	2	⅞ x 5	10.81 275	14.88 378	2.50 64	22.4 10.2
10 DN250	x	8 DN200	10.750 273.0	x	8.625 219.1	0 - 0.13 0 - 3.2	0° - 25'	0.90 8	2	1 x 5 ½	13.12 333	17.26 438	2.62 67	31.4 14.2

[3] Allowable Pipe End Separation and Deflection figures show the maximum nominal range of movement available at each joint for standard roll grooved pipe. Figures for standard cut grooved pipe may be doubled. These figures are maximums; for design and installation purposes, these figures should be reduced by: 50% for ¾ – 3 ½"/DN20 – DN90; and 25% for 4"/DN100 and larger.

NOTE

- Metric thread size bolts are available (color-coded gold) for all coupling sizes upon request. Contact Victaulic for details.

5.0 PERFORMANCE

Style 750 Reducing Coupling

Size Nominal inches DN			Size Actual Outside Diameter inches mm			Maximum Working Pressure[4] psi kPa	Maximum End Load[4] lb N
2 DN50	x	1 DN25	2.375 60.3	x	1.315 33.7	350 2413	500 2225
		1 ½ DN40			1.900 48.3	350 2413	1000 4450
2 ½	x	2 DN50	2.875 73.0	x	2.375 60.3	500 3447	2215 9850
DN65	x	2 DN50	3.000 76.1	x	2.375 60.3	350 2413	1550 6900
3 DN80	x	2 DN50	3.500 88.9	x	2.375 60.3	350 2413	1550 6900
		2 ½			2.875 73.0	500 3447	3250 14460
		DN65			3.00 76.1	350 2413	2475 11010
4 DN100	x	2 DN50	4.500 114.3	x	2.375 60.3	350 2413	1550 6900
		2 ½			2.875 73.0	350 2413	2275 10125
		DN65			3.000 76.1	350 2413	2475 11014
		3 DN80			3.500 88.9	500 3447	4810 21400
5	x	4 DN100	5.563 141.3	x	4.500 114.3	350 2413	5565 24765
165.1	x	4 114.3	6.500 165.1	x	4.500 114.3	350 2413	5565 24765
6 DN150	x	4 DN100	6.625 168.3	x	4.500 114.3	350 2413	5565 24765
		5			5.563 141.3	350 2413	8500 37825
8 DN200	x	165.1	8.625 219.1	x	6.500 165.1	350 2413	11610 51645
		6 DN150			6.625 168.3	350 2413	12060 53645
10 DN250	x	8 DN200	10.750 273.0	x	8.625 219.1	350 2413	20450 90970

[4] Working Presssure and End Load are total from all internal and external loads based on standard weight (ANSI) steel pipe standard roll or cut grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe and material. Maximum working pressure rating based on larger pipe size. Maximum end load rating based on smaller pipe size.

NOTES

- WARNING: FOR ONE-TIME FIELD USE ONLY the Maximum Joint Working Pressure may be increased to 1 ½ times the figures shown.
- For joint pressure ratings on additional carbon steel wall thicknesses see publication 06.15.

5.1 PERFORMANCE

Flow Data - Head Loss

Equivalent lengths of standard weight steel pipe are shown in the tables. All data is based on water flowing at +60°F/+16°C.

Flow Reducing

Size			Equivalent Pipe Length
Nominal inches DN			Small Diameter ft m
2 DN50	x	1 DN25	5.9 1.8
		1 ½ DN40	2.0 0.6
2 ½	x	2 DN50	1.9 0.6
DN65	x	2 DN50	1.9 0.6
3 DN80	x	2 DN50	5.5 1.7
		2 ½	3.8 1.2
		DN65	3.8 1.2
4 DN100	x	2 DN50	6.0 1.8
		2 ½	6.0 1.8
		DN65	6.0 1.8
		3 DN80	6.0 1.8
5	x	4 DN100	3.0 0.9
165.1	x	4 DN100	6.0 1.8
6 DN150	x	4 DN100	6.0 1.8
		5	4.5 1.4
8 DN200	x	165.1	7.3 2.2
		6 DN150	7.3 2.2
10 DN250	x	8 DN200	8.7 2.7

Flow Expanding

Size			Equivalent Pipe Length
Nominal inches DN			Small Diameter ft m
1 DN25	x	2 DN50	2.7 0.8
1 ½ DN40	x	2 DN50	1.9 0.6
2 DN50	x	2 ½	1.0 0.3
		DN65	1.0 0.3
		3 DN80	3.5 1.1
		4 DN100	3.0 0.9
2 ½	x	3 DN80	2.5 0.8
		4 DN100	3.0 0.9
DN65	x	3 DN80	2.5 0.8
		4 DN100	3.0 0.9
3 DN80	x	4 DN100	2.5 0.8
4 DN100	x	5	3.3 1.0
		165.1	4.6 1.4
		6 DN150	4.6 1.4
5	x	6 DN150	2.3 0.7
165.1	x	8 DN200	5.4 1.7
6 DN150	x	8 DN200	6.0 1.8
8 DN200	x	10 DN250	6.3 1.9

6.0 NOTIFICATIONS

⚠ WARNING

- **Victaulic RX roll sets must be used when grooving light-wall/thin-wall stainless steel pipe for use with Victaulic Couplings.**

Failure to use Victaulic RX roll sets when grooving light-wall/thin-wall stainless steel pipe may cause joint failure, resulting in serious personal injury and/or property damage.

⚠ WARNING

- **Read and understand all instructions before attempting to install, remove, adjust, or maintain any Victaulic piping products.**
- **Depressurize and drain the piping system before attempting to install, remove, adjust, or maintain any Victaulic piping products.**
- **Wear safety glasses, hardhat, and foot protection.**
- **Only No. 61 bull plugs shall be used with Style 750 reducing couplings in systems where a vacuum may develop.**

Failure to follow these instructions could result in death or serious personal injury and property damage.

NOTICE

- **Victaulic does not recommend the use of any furnace butt-welded pipe with sizes NPS 2"/DN50 and smaller Victaulic gasketed joint products. This includes, but is not limited to, ASTM A53 Type F pipe.**

7.0 REFERENCE MATERIALS

05.01: Victaulic Seal Selection Guide

06.15: Victaulic Pressure Ratings and End Loads for Victaulic Couplings on Steel Pipe

10.01: Victaulic Products for Fire Protection Piping Systems - Regulatory Approval Reference Guide

25.01: Victaulic Original Groove System (OGS) Groove Specifications

26.01: Victaulic Design Data

29.01: Victaulic Terms and Conditions of Sale

I-100: Victaulic Field Installation Handbook

FireLock™ Flange Adapter
Style 744

10.04

1.0 PRODUCT DESCRIPTION

Available Sizes

- 2 – 8" (50 – 200mm)

Maximum Working Pressure

- For maximum working pressure reference section 5.0 Perfomance

Application

- Designed for directly incorporating flanged components with ANSI CL. 125 or CL. 150 bolt hole patterns into a grooved pipe system
- Designed and recommended for use in fire protection systems only

Pipe Material

- Carbon Steel
- Stainless Steel
- For exceptions reference section 6.0 Notifications

2.0 CERTIFICATION/LISTINGS

c UL us LISTED   CLASSIFIED c UL us   FM APPROVED

See Victaulic publication 10.01 for details.

3.0 SPECIFICATIONS – MATERIAL

Flange Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Coating: Black enamel

☐ Optional: Hot dipped galvanized

Bolts/Nuts: Supplied by installer

Gasket: Grade "E" EPDM – Type A Vic-Plus Gasket System[1]

(Violet color code). FireLock products have been Listed by Underwriters Laboratories Inc. and Approved by Factory Mutual Research for wet and dry (oil free air) sprinkler services up to the rated working pressure using the Grade "E" Type A Vic-Plus Gasket System, requiring no field lubrication for most installation conditions.

[1] Standard gasket approved for dry pipe systems to –40°F (–40°C). Based on "typical" pipe surface conditions, supplemental lubricant is recommended for services installed below 0°F (-18°C) and for all dry pipe systems or systems to be subjected to air tests prior to being filled with water. Supplemental lubrication may also be rquired on pipe with raised or undercut weld seams or pipe that has voids and/or cracks at the weld seams.

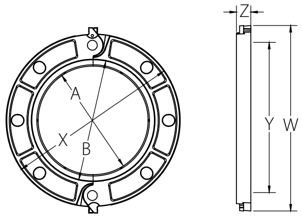
ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

4.0 DIMENSIONS

Style 744

Sizes 2 – 8" (50 – 200 mm)

ANSI Class 125 and 150 Flange



Size		No. Bolts[2] Required	Bolt/Nut Size[2]	Dimensions							Approx. Weight (Each)
				Sealing Surface							
Nominal inches DN	Actual Outside Diameter inches mm	Qty.	inches	A Max. inches mm	B Min. inches mm	W inches mm	X inches mm	Y inches mm	Z inches mm		lb kg
2 DN50	2.375 60.3	4	⅝ x 2¾	2.38 60	3.41 87	6.75 172	6.00 153	4.75 121	0.88 20		3.5 1.6
2½	2.875 73.0	4	⅝ x 3	2.88 73	3.91 99	7.88 200	7.00 178	5.50 140	1.00 24		4.8 2.2
3 DN80	3.500 88.9	4	⅝ x 3	3.50 89	4.53 115	8.38 211	7.50 191	6.00 152	1.00 25		5.5 2.5
4 DN100	4.500 114.3	8	⅝ x 3	4.50 114	5.53 140	9.88 251	9.00 229	7.50 191	1.00 25		6.8 3.1
5	5.563 141.3	8	¾ x 3½	5.56 141	6.71 170	11.00 277	10.00 254	8.50 216	1.13 27		8.3 3.8
6[3] DN150	6.625 168.3	8	¾ x 3½	6.63 168	7.78 198	12.00 303	11.00 280	9.50 241	1.13 27		9.9 4.5
8[3] DN200	8.625 219.1	8	¾ x 3½	8.63 219	9.94 252	14.50 369	13.50 343	11.75 298	1.25 30		14.0 6.4

2 Total bolts required to be supplied by installer. Bolt sizes for conventional flange-to-flange connection. Longer bolts are required when Vic-Flange adapter is utilized with wafer-type valves.

3 Not available with Vic-Plus gasket system. Lubrication is required.

NOTES

- Working Pressure and End Load are total, from all internal and external loads, based on standard weight steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.
- WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1½ times the figures shown.
- Style 744 FireLock Flange adapters provide rigid joints when used on pipe with standard roll or cut groove dimensions and consequently allow no linear or angular movement at the joint.
- WARNING: Depressurize and drain the piping system before attempting to install, remove, or adjust any Victaulic piping products.

5.0 PERFORMANCE

Size			
Nominal inches DN	**Actual Outside Diameter** inches mm	**Maximum Working Pressure** psi kPa	**Maximum End Load** lbf N
2 DN50	2.375 60.3	175 1207	775 3,448
2 ½	2.875 73.0	175 1207	1,100 4,894
3 DN80	3.500 88.9	175 1207	1,600 7,118
4 DN100	4.500 114.3	175 1207	2,700 12,010
5	5.563 141.3	175 1207	4,200 18,682
6 DN150	6.625 168.3	175 1207	6,000 26,690
8 DN200	8.625 219.1	175 1207	10,000 44,482

6.0 NOTIFICATIONS

Important Installation Considerations

1. The Style 744 (2 – 8"/50 – 200 mm) design incorporates small teeth inside the key shoulder I.D. to prevent rotation.
2. FireLock Flange adapter shall not be used on FireLock or "V" Style fittings. Prior to installation, verify that there will not be interference between the flanges and other components in the system. When wafer or lug-type valves are used adjoining a Victaulic fitting, check disc dimensions to assure proper clearance.
3. FireLock Flange adapters shall not be used as anchor points for tie-rods across nonrestrained joints. Mating rubber faced flanges, valves, etc. require the use of a FireLock Flange washer.
4. The sealing surface of the mating flange face, area A-B noted in the above drawing, shall be free from gouges, undulations or deformities of any type for effective sealing.
5. FireLock Flange adapter gaskets shall be assembled with the color coded lip on the pipe and the other lip facing the mating flange.
6. Flange Washers: FireLock Flange adapters require a smooth hard surface at the mating flange face for effective sealing. Some applications for which the Vic-Flange adapter is otherwise well suited do not provide an adequate mating surface. In such cases, it is recommended that a metal Flange Washer be inserted between the FireLock Flange adapter and the mating flange to provide the necessary sealing surface.

Typical applications where a Flange Washer shall be used are:

A. When mating to a serrated flange: a standard flat flange gasket should be used adjacent to the serrated flange and then the Flange Washer is inserted between the FireLock Flange adapter and the flange gasket.

B. When mating to a wafer valve: where typical valves are rubber lined and partially rubber faced (smooth or not), the Flange Washer is placed between the valve and the FireLock Flange adapter.

C. When mating a rubber faced flange: the Flange Washer is placed between the FireLock Flange adapters and the rubber faced flange.

D. When mating AWWA cast flanges to IPS flanges: the Flange Washer is placed between two FireLock Flanges. The hinge points must be oriented approximately 90° to each other. If one flange is not a FireLock Flange adapter (e.g. flanged valve), then a standard flat flange gasket must be placed adjacent to that flange and the Flange Washer inserted between the flange gasket and the FireLock Flange adapter.

E. When mating to components (valves, strainers, etc.) where the component flange face has an insert: follow the same arrangement as in Application A.

F. When mating to a Series 705-W Butterfly valve, Style 744 may only be used on one side of the connection.

When ordering Flange Washers, always specify product style (Style 744) and size to assure proper Flange Washer is supplied.

NOTICE
• **Victaulic does not recommend the use of any furnace butt-welded pipe with sizes 2"/DN50 and smaller Victaulic gasketed joint products. This includes, but is not limited to, ASTM A53 Type F pipe.**

7.0 REFERENCE MATERIALS

10.01: Regulatory Approval Reference Guide

I-100: Field Installation Handbook

No. 20 Tee

No. 10 Elbow

1.0 PRODUCT DESCRIPTION

Available Sizes

- ¾ – 24"/DN20 – DN600

Pipe Material

- Carbon steel

Maximum Working Pressure

- Pressure ratings for Victaulic standard fittings conform to the ratings of Victaulic Style 77 couplings (refer to publication 06.04 for more information).

Application

- Connects pipe, provides change in direction and adapts sizes or components
- Supplied with Victaulic Original Groove System (OGS) grooves
- Exclusively for use with Victaulic couplings, valves, accessories and pipe which feature ends formed with the Victaulic OGS groove profile

NOTES

- For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information.
- These fittings are not intended for use with Victaulic plain end couplings. Intended for use only in grooved piping systems. When connecting wafer or lug type butterfly valves directly to Victaulic fittings using Style 741 or Style 743 flange adapters, be sure to check disc clearance dimensions with I.D. dimension of fitting.

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

2.0 CERTIFICATION/LISTINGS

EN 10311
CPR (EU)
No. 305/2011

BS EN 10311
CPR (UK)
2019 No. 465

NOTES

- When supplied as "hot dip galvanized" the following fittings are UL Classified in accordance with ANSI/NSF 61 and for use on cold +86°F/+30°C potable water service and ANSI/NSF 372: No. 10 90° Elbow, No. 11 45° Elbow, No. 12 22 ½° Elbow, No. 13 11 ¼° Elbow, No. 100 90° Long Radius Elbow, No. 110 45° Long Radius Elbow, No. 20 Tee, No. 25 Tee with Grooved Branch, No. 30 45° Lateral, No. 60 Cap, No. 50 Concentric Reducers, No. 51 Eccentric Reducers.
- The following Victaulic fittings are VdS approved: No.10 90° Elbow, No.11 45° Elbow, No.20 Tee and No.60 Cap.
- The following Victaulic fittings are LPCB approved: No.10 90° Elbow, No.11 45° Elbow, No.12 22 ½ Elbow, No.13 11 ¼° Elbow, No.30 45° Lateral, No.30-R Reducing Lateral, No.100 Long Radius Elbow, No.110 Long Radius Elbow, No.20 Tee, No.35 Cross, No.60 Cap, No.25 Reducing Tee, No.33 True Wye, No.50 Concentric Reducer, No.51 Eccentric Reducer and No.29M Tee with Threaded Branch.
- The following Victaulic fittings are FM approved: No.10 90° Elbow, No.11 45° Elbow, No.12 22 ½ Elbow, No.13 11 ¼° Elbow, No.30 45° Lateral, No.100 Long Radius Elbow, No.20 Tee, No.35 Cross, No.60 Cap, No.25 Reducing Tee and No.50 Concentric Reducer.
- Download publication 10.01 for Fire Protection Certifications/Listings Reference Guide to view which sizes of the fittings listed above have active fire protection approvals.

3.0 SPECIFICATIONS – MATERIAL

Fitting: (specify choice)

- ☐ Standard: Ductile iron conforming to ASTM A536, Grade 65-45-12.
- ☐ Optional: Segmentally welded carbon steel, standard wall, conforming to ASTM A53, Type E or S, Gr. B

Nipples: (specify choice)

- ☐ ¾ – 6"/DN20 – DN150: Carbon steel, Schedule 40, conforming to ASTM A53, Type E or S, Gr. B
- ☐ 8 – 12"/DN200 – DN300: Carbon steel, standard wall, conforming to ASTM A53, Type E or S, Gr. B

Flanged Adapter Nipples: (specify choice)

- ☐ Class 125 Flange: Cast iron conforming to ANSI B16.1
- ☐ Class 150 Flange: Carbon steel conforming to ANSI B16.5, raised or flat face
- ☐ Class 300 Flange: Carbon steel conforming to ANSI B16.5, raised or flat face

Fitting Coating: (specify choice)

- ☐ Standard: Orange enamel
- ☐ Optional: Hot dip galvanized and others. Some fittings supplied electroplated as standard – see product specifications

Flanged Adapter Nipple Coating: (specify choice)

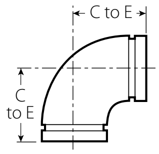
- ☐ Standard: None (Unfinished)
- ☐ Optional: Orange enamel, hot dip galvanized and others

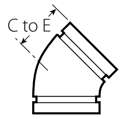
4.0 DIMENSIONS

Elbows

No. 10 90° Elbow

No. 11 45° Elbow





Size		No. 10 90° Elbow		No. 11 45° Elbow	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	2.25 57	0.5 0.2	1.50 38	0.5 0.2
1 DN25	1.315 33.7	2.25 57	0.6 0.2	1.75 44	0.5 0.2
1 ¼ DN32	1.660 42.4	2.75 70	0.8 0.4	1.75 44	0.6 0.3
1 ½ DN40	1.900 48.3	2.75 70	1.0 0.5	1.75 44	0.8 0.4
2 DN50	2.375 60.3	3.25 83	1.8 0.8	2.00 51	1.3 0.6
2 ½	2.875 73.0	3.75 95	3.0 1.3	2.25 57	2.1 1.0
DN65	3.000 76.1	3.75 95	3.1 1.4	2.25 57	2.3 1.0
3 DN80	3.500 88.9	4.25 108	4.5 2.0	2.50 64	3.0 1.3
3 ½ DN90	4.000 101.6	4.50 114	5.6 2.5	2.75 70	4.0 1.8
	4.250 108.0	5.00 127	6.2 2.8	3.00 76	4.6 2.1
4 DN100	4.500 114.3	5.00 127	6.8 3.1	3.00 76	5.2 2.4
4 ½	5.000 127.0	5.00 127	8.6 3.9	3.13 79	5.9 2.7
	5.250 133.0	5.50 140	10.3 4.7	3.25 83	6.6 3.0
DN125	5.500 139.7	5.50 140	9.9 4.5	3.25 83	7.2 3.2
5	5.563 141.3	5.50 140	10.1 4.6	3.25 83	7.4 3.4
	6.000 152.4	6.50 (sw) 165	13.3 6.0	3.50 (sw) 89	9.5 4.3
	6.250 159.0	6.50 165	13.0 5.9	3.25 83	9.5 4.3
	6.500 165.1	6.50 165	15.5 7.0	3.50 89	9.7 4.4
6 DN150	6.625 168.3	6.50 165	15.3 6.9	3.50 89	10.2 4.6
200A	216.3	7.75 197	34.7 15.7	4.25 108	14.4 6.5

[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

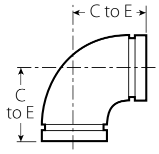
NOTE

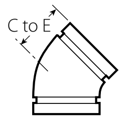
- All fittings are ductile iron unless otherwise noted with an (sw).

4.0 DIMENSIONS (CONTINUED)

Elbows

No. 10 90° Elbow
No. 11 45° Elbow





Size		No. 10 90° Elbow		No. 11 45° Elbow	
Nominal inches DN	Actual Outside Diameter inches mm	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg
8 DN200	8.625 219.1	7.75 197	27.5 12.5	4.25 108	18.6 8.4
250A	267.4	9.00 229	67.8 30.7	4.75 121	28.1 12.7
10 DN250	10.750 273.0	9.00 229	50.0 22.7	4.75 121	37.5 17.0
300A	318.5	10.00 254	73.5 33.3	5.25 133	41.3 18.7
12 DN300	12.750 323.9	10.00 254	79.3 36.0	5.25 133	45.0 20.4
14[1] DN350	14.000 355.6	14.00 356	146.0 66.2	5.80 147	78.0 35.4
	14.843 377.0	14.88 378	168.0 76.2	6.15 156	82.0 37.2
16[1] DN400	16.000 406.4	16.00 406	190.0 86.2	6.63 168	88.2 40.0
	16.772 426.0	16.75 425	216.0 98.0	6.95 177	98.1 44.5
18[1] DN450	18.000 457.2	18.00 457	241.0 109.3	7.46 189	123.0 55.8
	18.898 480.0	18.90 480	291.0 132.0	7.83 199	123.2 55.9
20[1] DN500	20.000 508.0	20.00 508	296.0 134.3	8.28 210	151.0 68.5
	20.866 530.0	20.88 530	355.0 161.0	8.64 219	179.0 81.2
22 DN550	22.000 558.8	25.00 635	386.0 175.1	12.11 308	210.0 95.3
24[1] DN600	24.000 609.6	24.00 610	475.0 215.5	9.94 252	240.0 108.9
	24.803 630.0	24.75 629	545.0 247.2	10.27 261	275.4 124.9
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05				

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

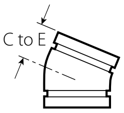
NOTE

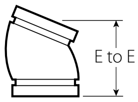
- All fittings are ductile iron unless otherwise noted with an (sw).

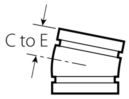
4.0 DIMENSIONS (CONTINUED)

Elbows

No. 12 22½° Elbow
No. 13 11¼° Elbow







Size		No. 12 22½° Elbow		No. 12G (GSNK) 22½° Elbow		No. 13 11¼° Elbow	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	1.63 (sw) 41	0.4 0.2	NA	NA	1.38 (sw) 35	0.4 0.2
1 DN25	1.315 33.7	1.63 (sw) 41	0.5 0.2	3.25 83	0.6 0.3	1.38 (sw) 35	0.4 0.2
1¼ DN32	1.660 42.4	1.75 44	0.8 0.4	NA	NA	1.38 35	0.6 0.3
1½ DN40	1.900 48.3	1.75 44	1.0 0.4	NA	NA	1.38 35	0.6 0.3
2 DN50	2.375 60.3	1.88 48	1.2 0.5	3.75 95	1.4 0.6	1.38 35	1.0 0.4
2½	2.875 73.0	2.00 (sw) 51	2.4 1.1	4.00 102	2.0 0.9	1.50 38	1.6 0.7
DN65	3.000 76.1	2.25 57	2.5 1.1	NA	NA	1.50 38	1.7 0.8
3 DN80	3.500 88.9	2.25 (sw) 57	3.1 1.4	4.50 114	3.1 1.4	1.50 38	2.0 0.9
3½ DN90	4.000 101.6	2.50 (sw) 64	4.0 1.8	NA	NA	1.75 (sw) 44	2.8 1.3
	4.250 108.0	2.88 (sw) 73	+	NA	NA	1.75 (sw) 44	+
4 DN100	4.500 114.3	2.88 73	4.8 2.2	5.25 133	4.8 2.2	1.75 44	3.3 1.5
4½	5.000 127.0	2.88 (sw) 73	+	NA	NA	1.88 (sw) 48	+
	5.250 133.0	2.88 (sw) 73	+	NA	NA	2.00 (sw) 51	+
DN125	5.500 139.7	2.88 73	6.3 2.9	NA	NA	2.00 51	4.6 2.1
5	5.563 141.3	2.88 (sw) 73	7.8 3.5	NA	NA	2.00 (sw) 51	5.0 2.3
	6.000 152.4	3.13 (sw) 79	+	NA	NA	2.00 (sw) 51	+
	6.250 159.0	3.13 (sw) 79	+	NA	NA	2.00 (sw) 51	+
	6.500 165.1	3.13 79	10.4 4.7	NA	NA	2.00 51	7.1 3.2
6 DN150	6.625 168.3	3.13 (sw) 79	12.2 5.5	6.25 159	12.2 5.5	2.00 51	6.4 2.9

[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

NA = Not Available

"+" = Contact Victaulic for details

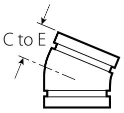
NOTE

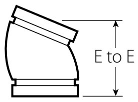
- All fittings are ductile iron unless otherwise noted with an (sw).

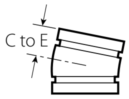
4.0 DIMENSIONS (CONTINUED)

Elbows

No. 12 22 ½° Elbow
No. 13 11 ¼° Elbow







Size		No. 12 22 ½° Elbow		No. 12G (GSNK) 22 ½° Elbow		No. 13 11 ¼° Elbow	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
8 DN200	8.625 219.1	3.88 (sw) 98	20.0 9.1	7.75 197	18.1 8.2	2.00 51	8.2 3.7
10 DN250	10.750 273.0	4.38 111	30.0 13.6	NA	NA	2.13 54	11.8 5.3
12 DN300	12.750 323.9	4.88 124	40.0 18.1	NA	NA	2.25 57	29.3 13.3
14[1] DN350	14.000 355.6	5.00 (sw) 127	46.0 20.9	NA	NA	3.50 (sw) 89	32.0 14.5
16[1] DN400	16.000 406.4	5.00 (sw) 127	58.0 26.3	NA	NA	4.00 (sw) 102	42.0 19.1
18[1] DN450	18.000 457.2	5.50 (sw) 140	65.0 29.5	NA	NA	4.50 (sw) 114	53.0 24.0
20[1] DN500	20.000 508.0	6.00 (sw) 152	78.6 35.7	NA	NA	5.00 (sw) 127	65.0 29.5
22[1] DN550	22.000 558.8	6.50 (sw) 165	125.0 56.7	NA	NA	5.50 (sw) 140	80.0 36.3
24[1] DN600	24.000 609.6	7.00 (sw) 178	140.0 63.5	NA	NA	6.00 (sw) 152	94.5 42.9
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05						

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

NA = Not Available

"+" = Contact Victaulic for details

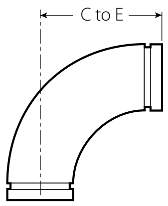
NOTE

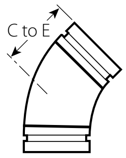
- All fittings are ductile iron unless otherwise noted with an (sw).

4.0 DIMENSIONS (CONTINUED)

Elbows

No. 100 90° Long Radius Elbow
No. 110 45° Long Radius Elbow





Size		No. 100 90° 1½D Long Radius Elbow		No. 110 45° 1½D Long Radius Elbow	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	2.50 (s) 64	0.4 0.2	1.75 (s) 44	0.4 0.2
1 DN25	1.315 33.7	2.88 (s) 73	0.8 0.4	2.25 (s) 57	0.6 0.3
1¼ DN32	1.660 42.4	3.25 (s) 83	1.1 0.5	2.38 (s) 60	0.9 0.4
1½ DN40	1.900 48.3	3.63 (s) 92	2.2 1.0	2.50 (s) 64	1.1 0.5
2 DN50	2.375 60.3	4.38 111	2.6 1.2	2.75 70	1.9 0.9
2½	2.875 73.0	5.13 130	3.4 1.5	3.13 (s) 79	3.0 1.4
3 DN80	3.500 88.9	5.88 149	6.0 2.7	3.38 86	3.8 1.7
3½ DN90	4.000 101.6	6.63 (s) 168	8.7 3.9	3.63 (s) 92	5.6 2.5
4 DN100	4.500 114.3	7.50 191	10.8 4.9	4.00 102	7.4 3.4
5	5.563 141.3	9.25 235	18.0 8.2	4.25 108	14.8 6.7
	6.500 165.1	10.75 273	25.8 11.7	5.50 140	15.8 7.2
6 DN150	6.625 168.3	10.75 273	30.4 13.8	5.38 137	16.7 7.6
8 DN200	8.625 219.1	14.25 362	68.5 31.1	7.25 184	36.0 16.3
10 DN250	10.750 273.0	15.00 381	81.6 37.0	6.25 159	40.1 18.2
12 DN300	12.750 323.9	18.00 457	138.0 62.6	7.50 191	69.6 31.6
14[1] DN350	14.000 355.6	21.00 533	222.7 101.0	8.75 222	112.4 51.0
16[1] DN400	16.000 406.4	24.00 610	302.0 137.0	10.00 254	158.7 72.0
18[1] DN450	18.000 457.2	27.00 686	421.8 191.3	11.25 286	224.9 102.0
20[1] DN500	20.000 508.0	30.00 762	498.2 226.0	12.50 318	246.9 112.0
22[1] DN550	22.000 558.8	36.00 (s) 914	400.0 181.4	16.50 (s) 419	205.0 93.0
24[1] DN600	24.000 609.6	36.00 914	765.0 347.0	15.00 381	370.4 168.0
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05				

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

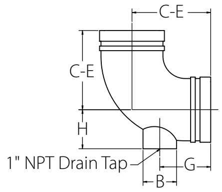
(s) = Carbon Steel

NOTE

- All fittings are ductile iron unless otherwise noted with an (s).

4.1 DIMENSIONS

No. 10-DR
90° Drain Elbow



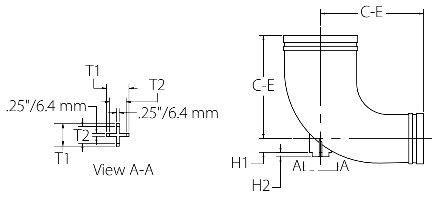
Size		No. 10-DR 90° Drain Elbow					Weight
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**ØB** inches mm	**G** inches mm	**H** inches mm	**Drain Tap NPT** inches mm	**Approx. (Each)** lb kg
2½	2.875 73.0	3.75 95	1.81 46	2.75 70	1.68 43	1 25	3.5 1.6
3 DN80	3.500 88.9	4.25 108	1.81 46	2.75 70	2.13 54	1 25	4.8 2.2
4 DN100	4.500 114.3	5.00 127	1.81 46	2.75 70	2.63 67	1 25	7.8 3.5
6 DN150	6.625 168.3	6.50 165	1.81 46	2.75 70	3.65 93	1 25	18.1 8.2
8 DN200	8.625 219.1	7.75 197	1.81 46	2.75 70	4.50 114	1 25	29.6 13.4

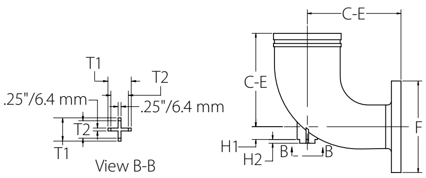
NOTE
- ISO 7-R thread options are available; contact Victaulic.

4.2 DIMENSIONS

Reducing Base Support Elbow

No. R-10G
No. R-10F





Size						No. R-10G 90° Reducing Base Support Elbow Groove x Groove						No. R-10F 90° Reducing Base Support Elbow Groove x Class 150 Flange*						
Nominal inches DN			**Actual Outside Diameter** inches mm			**C to E** inches mm	**H1** inches mm	**H2** inches mm	**T1** inches mm	**T2** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**ØF** inches mm	**H1** inches mm	**H2** inches mm	**T1** inches mm	**T2** inches mm	**Approx. Weight (Each)** lb kg
6 DN150	x	4 DN100	6.625 168.3	x	4.500 114.3	9.19 233	1.25 32	0.38 10	2.00 51	1.50 38	33.0 15.0	9.19 233	9.00 229	1.25 32	0.38 10	2.00 51	1.50 38	46.0 20.9
		5			5.563 141.3	9.00 229	1.50 38	0.38 10	2.00 51	1.50 38	37.0 16.8	9.00 229	10.00 254	1.50 38	0.38 10	2.00 51	1.50 38	52.0 23.6
8 DN200	x	6 DN150	8.625 219.1	x	6.625 168.3	10.50 267	2.13 54	0.38 10	2.00 51	1.50 38	51.0 23.1	10.50 267	11.00 279	2.13 54	0.38 10	2.00 51	1.50 38	70.0 31.8
10 DN250	x	8 DN200	10.750 273.0	x	8.625 219.1	12.00 305	2.38 60	0.38 10	2.00 51	1.50 38	88.0 39.9	12.00 305	13.50 343	2.38 60	0.38 10	2.00 51	1.50 38	118.0 53.5

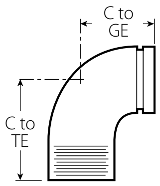
* Contact Victaulic for additional flange end options.

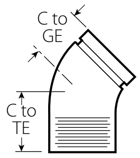
For long radius base support elbow options, please refer to publication 07.13.

4.3 DIMENSIONS

Adapter Elbow

No. 18 90° Adapter Elbow
No. 19 45° Adapter Elbow





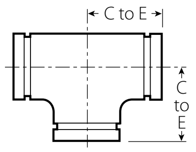
Size		No. 18 90° Adapter Elbow Groove x Male Thread[1]			No. 19 45° Adapter Elbow Groove x Male Thread[1]		
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to GE** inches mm	**C to TE** inches mm	**Approx. Weight (Each)** inches mm	**C to GE** inches mm	**C to TE** inches mm	**Approx. Weight (Each)** lb kg
3/4 DN20	1.050 26.9	2.25 57	2.25 57	0.5 0.2	1.50 38	1.50 38	0.5 0.2
1 DN25	1.315 33.7	2.25 57	2.25 57	0.6 0.3	NA	NA	NA
1 ¼ DN32	1.660 42.4	2.75 70	2.75 70	1.2 0.5	NA	NA	NA
1 ½ DN40	1.900 48.3	2.75 70	2.75 70	1.4 0.7	1.75 44	1.75 44	0.9 0.4
2 DN50	2.375 60.3	3.25 83	4.25 108	2.5 1.1	2.00 51	2.00 51	1.6 0.7
2 ½	2.875 73.0	3.75 95	3.75 95	3.7 1.7	2.25 57	2.25 57	2.3 1.0
3 DN80	3.500 88.9	4.25 108	6.00 152	6.6 3.0	2.50 64	4.25 108	5.0 2.3
4 DN100	4.500 114.3	5.00 127	7.25 184	10.0 4.5	NA	NA	NA
6 DN150	6.625 168.3	6.50 165	6.50 165	19.0 8.6	3.50 89	3.50 89	10.8 4.9

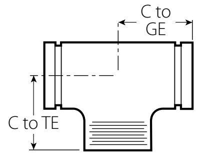
[1] Available with British Standard Pipe Threads, specify "BSP" clearly on order.

NA = Not Available

4.4 DIMENSIONS

Tees, Crosses and True Wyes
No. 20
No. 29M





Size		No. 20 Tee		No. 29M Tee Groove x Male Thread² Branch		
Nominal inches DN	Actual Outside Diameter inches mm	C to E inches mm	Approx. Weight (Each) lb kg	C to GE inches mm	C to TE lb kg	Approx. Weight (Each) inches mm
¾ DN20	1.050 26.9	2.25 57	0.8 0.4	2.25 (sw) 57	2.25 (sw) 57	0.6 0.3
1 DN25	1.315 33.7	2.25 57	0.9 0.4	2.25 (sw) 57	2.25 (sw) 57	0.9 0.4
1 ¼ DN32	1.660 42.4	2.75 70	1.5 0.7	2.75 70	2.75 70	1.6 0.7
1 ½ DN40	1.900 48.3	2.75 70	1.7 0.8	2.75 70	2.75 70	1.8 0.8
2 DN50	2.375 60.3	3.25 83	2.8 1.3	3.25 83	4.25 108	3.5 1.6
2 ½	2.875 73.0	3.75 95	4.8 2.2	3.75 (sw) 95	3.75 (sw) 95	4.3 2.0
DN65	3.000 76.1	3.75 95	5.3 2.4	3.75 (sw) 95	3.75 (sw) 95	5.2 2.4
3 DN80	3.500 88.9	4.25 108	6.4 2.9	4.25 (sw) 108	4.25 (sw) 108	7.2 3.3
3 ½ DN90	4.000 101.6	4.50 (sw) 114	7.9 3.6	4.50 (sw) 114	4.50 (sw) 114	7.9 3.6
	4.250 108.0	5.00 127	12.0 5.4	5.00 (sw) 127	5.00 (sw) 127	15.5 7.0
4 DN100	4.500 114.3	5.00 127	11.3 5.1	5.00 127	7.25 184	16.3 7.4
4 ½	5.000 127.0	5.25 (sw) 133	15.0 6.8	5.25 (sw) 133	5.25 (sw) 133	15.0 6.8
	5.250 133.0	5.50 140	16.2 7.3	5.50 (sw) 140	5.50 (sw) 140	17.8 8.1
DN125	5.500 139.7	5.50 140	17.8 8.1	5.50 (sw) 140	5.50 (sw) 140	17.8 8.1
5	5.563 141.3	5.50 140	17.8 8.1	5.50 (sw) 140	5.50 (sw) 140	24.0 10.9
	6.000 152.4	6.50 (sw) 165	+	6.50 (sw) 165	6.50 (sw) 165	25.7 11.7
	6.250 159.0	6.50 (sw) 165	+	6.50 (sw) 165	6.50 (sw) 165	27.1 12.3
	6.500 165.1	6.50 165	25.0 11.3	6.50 (sw) 165	6.50 (sw) 165	28.0 12.7
6 DN150	6.625 168.3	6.50 165	25.7 11.7	6.50 (sw) 165	6.50 (sw) 165	33.0 15.0
200A	216.3	7.75 197	43.3 19.6	NA	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

2 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(sw) = Carbon Steel Segmentally Welded

NA = Not Available

"+" = Contact Victaulic for details

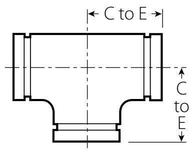
NOTES

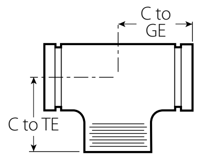
- All fittings are ductile iron unless otherwise noted with an (sw).

4.3 DIMENSIONS (CONTINUED)

Tees, Crosses and True Wyes

No. 20
No. 29M





Size		No. 20 Tee		No. 29M Tee Groove x Male Thread² Branch		
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to GE** inches mm	**C to TE** lb kg	**Approx. Weight (Each)** inches mm
8 DN200	8.625 219.1	7.75 197	49.5 22.5	7.75 (sw) 197	7.75 (sw) 197	47.6 21.6
250A	267.4	9.00 229	66.0 29.9	NA	NA	NA
10 DN250	10.750 273.0	9.00 229	72.4 32.8	9.00 (sw) 229	9.00 (sw) 229	99.0 44.9
300A	318.5	10.00 254	95.0 43.1	NA	NA	NA
12 DN300	12.750 323.9	10.00 254	107.2 48.6	10.00 (sw) 254	10.00 (sw) 254	133.0 60.3
14[1] DN350	14.000 355.6	11.00 (sw) 279	150.0 68.0	11.00 (sw) 279	11.00 (sw) 279	+
	14.843 377.0	11.50 292	159.3 72.3	NA	NA	NA
16[1] DN400	16.000 406.4	12.00 (sw) 305	188.0 85.3	12.00 (sw) 305	12.00 (sw) 305	+
	16.772 426.0	13.00 330	211.6 96.0	NA	NA	NA
18[1] DN450	18.000 457.2	15.50 (sw) 394	200.0 90.7	15.50 (sw) 394	15.50 (sw) 394	+
	18.898 480.0	14.57 370	211.6 96.0	NA	NA	NA
20[1] DN500	20.000 508.0	17.25 (sw) 438	339.0 153.8	17.25 (sw) 438	17.25 (sw) 438	+
	20.866 530.0	15.39 391	382.0 173.3	NA	NA	NA
22[1] DN550	22.000 558.8	19.00 (sw) 483	468.0 212.3	19.00 (sw) 483	19.00 (sw) 483	+
24[1] DN600	24.000 609.6	20.00 (sw) 508	592.0 268.5	20.00 (sw) 508	20.00 (sw) 508	+
	24.803 630.0	17.37 441	502.0 227.7	NA	NA	NA
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05					

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

2 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(sw) = Carbon Steel Segmentally Welded

NA = Not Available

"+" = Contact Victaulic for details

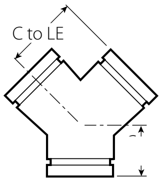
NOTES

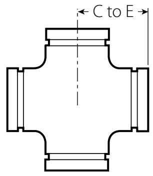
- All fittings are ductile iron unless otherwise noted with an (sw).

4.4 DIMENSIONS

Tees, Crosses and True Wyes

No. 33
No. 35





Size		No. 33 True Wye			No. 35 Cross	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to LE** inches mm	**C to SE** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	2.25 (sw) 57	2.00 (sw) 51	0.8 0.4	2.25 (sw) 57	0.9 0.4
1 DN25	1.315 33.7	2.25 (sw) 57	2.25 (sw) 57	1.1 0.5	2.25 (sw) 57	1.3 0.6
1 ¼ DN32	1.660 42.4	2.75 (sw) 70	2.50 (sw) 64	1.5 0.7	2.75 (sw) 70	2.1 1.0
1 ½ DN40	1.900 48.3	2.75 (sw) 70	2.75 (sw) 70	1.8 0.8	2.75 (sw) 70	2.5 1.1
2 DN50	2.375 60.3	3.25 (sw) 83	2.75 (sw) 70	2.5 1.1	3.25 83	4.0 1.8
2 ½	2.875 73.0	3.75 (sw) 95	3.00 (sw) 76	5.1 2.3	3.75 95	6.1 2.8
DN65	3.000 76.1	3.75 (sw) 95	3.25 (sw) 83	5.5 2.5	3.75 95	7.8 3.5
3 DN80	3.500 88.9	4.25 (sw) 108	3.25 (sw) 83	6.1 2.8	4.25 108	11.8 5.4
3 ½ DN90	4.000 101.6	4.50 (sw) 114	3.50 (sw) 89	9.6 4.4	4.50 (sw) 114	11.5 5.2
	4.250 108.0	5.00 (sw) 127	3.75 (sw) 95	9.7 4.4	5.00 127	18.4 8.3
4 DN100	4.500 114.3	5.00 127	3.75 95	10.0 4.5	5.00 127	15.8 7.2
4 ½	5.000 127.0	5.25 (sw) 133	4.00 (sw) 102	12.5 5.7	5.25 (sw) 133	18.5 8.4
	5.250 133.0	5.50 (sw) 140	4.00 (sw) 102	13.8 6.2	5.50 (sw) 140	19.0 8.6
DN125	5.500 139.7	5.50 (sw) 140	4.00 (sw) 102	15.0 6.8	5.50 (sw) 140	19.5 8.8
5	5.563 141.3	5.50 (sw) 140	4.00 (sw) 102	15.0 6.8	5.50 140	28.6 13.0
	6.000 152.4	6.50 (sw) 165	4.50 (sw) 114	17.5 7.9	6.50 (sw) 165	22.0 10.0
	6.250 159.0	6.50 (sw) 165	4.50 (sw) 114	19.9 9.0	6.50 165	41.4 18.8
	6.500 165.1	6.50 (sw) 165	4.50 (sw) 114	21.5 9.8	6.50 165	44.0 20.0
6 DN150	6.625 168.3	6.50 (sw) 165	4.50 (sw) 114	22.3 10.1	6.50 165	46.0 20.9
8 DN200	8.625 219.1	7.75 (sw) 197	6.00 (sw) 152	36.0 16.3	7.75 (sw) 197	48.0 21.8

[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

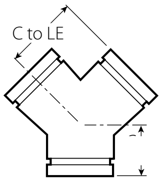
NOTE

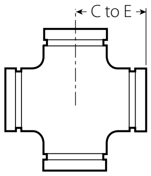
- All fittings are ductile iron unless otherwise noted with an (sw).

4.4 DIMENSIONS (CONTINUED)

Tees, Crosses and True Wyes

No. 33
No. 35





Size		No. 33 True Wye			No. 35 Cross	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to LE** inches mm	**C to SE** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
10 DN250	10.750 273.0	9.00 (sw) 229	6.50 (sw) 165	54.5 24.7	9.00 (sw) 229	70.0 31.8
12 DN300	12.750 323.9	10.00 (sw) 254	7.00 (sw) 178	80.0 36.3	10.00 (sw) 254	110.0 49.9
14[1] DN350	14.000 355.6	11.00 (sw) 279	7.50 (sw) 191	134.2 60.9	11.00 (sw) 279	198.0 89.8
16[1] DN400	16.000 406.4	12.00 (sw) 305	8.00 (sw) 203	167.0 75.7	12.00 (sw) 305	250.0 113.4
18[1] DN450	18.000 457.2	15.50 (sw) 394	8.50 (sw) 216	180.0 81.6	15.50 (sw) 394	350.0 158.8
20[1] DN500	20.000 508.0	17.25 (sw) 438	9.00 (sw) 229	200.0 90.7	17.25 (sw) 438	452.0 205.0
22[1] DN550	22.000 558.8	19.00 (sw) 483	9.50 (sw) 241	225.0 102.1	19.00 (sw) 483	624.0 283.0
24[1] DN600	24.000 609.6	20.00 (sw) 508	10.00 (sw) 254	250.0 113.4	20.00 (sw) 508	795.0 360.6
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05 AGS™					

[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

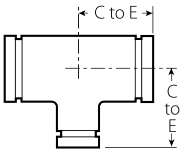
NOTE

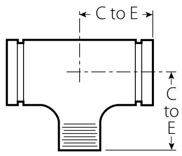
- All fittings are ductile iron unless otherwise noted with an (sw).

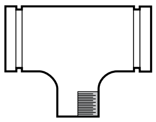
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F







Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
1 x 1 x ¾ DN25 DN25 DN20	1.315 x 1.315 x 1.050 33.7 33.7 26.9	2.25 (sw) 57	0.8 0.4	2.25 (sw) 57	0.8 0.4	NA	NA
1 ¼ x 1 ¼ x ¾ DN32 DN32 DN20	1.660 x 1.660 x 1.050 42.4 42.4 26.9	2.75 (sw) 70	1.0 0.5	2.75 (sw) 70	1.0 0.5	NA	NA
1 DN25	1.315 33.7	2.75 (sw) 70	1.3 0.6	2.75 (sw) 70	1.5 0.7	NA	NA
1 ½ x 1 ½ x ¾ DN40 DN40 DN20	1.900 x 1.900 x 1.050 48.3 48.3 26.9	2.75 (sw) 70	1.5 0.7	2.75 (sw) 70	1.5 0.7	NA	NA
1 DN25	1.315 33.7	2.75 (sw) 70	1.5 0.7	2.75 (sw) 70	1.8 0.8	NA	NA
1 ¼ DN32	1.660 42.4	2.75 (sw) 70	2.1 1.0	2.75 (sw) 70	1.7 0.8	NA	NA
2 x 2 x ¾ DN50 DN50 DN20	2.375 x 2.375 x 1.050 60.3 60.3 26.9	3.25 83	2.5 1.1	3.25 83	2.5 1.1	NA	NA
1 DN25	1.315 33.7	3.25 83	2.7 1.2	3.25 83	2.7 1.2	NA	NA
1 ¼ DN32	1.660 42.4	3.25 (sw) 83	2.3 1.0	3.25 (sw) 83	2.3 1.0	NA	NA
1 ½ DN40	1.900 48.3	3.25 83	3.2 1.5	3.25 83	3.2 1.5	NA	NA
2 ½ x 2 ½ x ¾ DN20	2.875 x 2.875 x 1.050 73.0 73.0 26.9	3.75 (sw) 95	3.9 1.8	3.75 (sw) 95	3.0 1.4	NA	NA
1 DN25	1.315 33.7	3.75 95	3.8 1.7	3.75 95	3.8 1.7	NA	NA
1 ¼ DN32	1.660 42.4	3.75 95	4.0 1.8	3.75 95	4.0 1.8	NA	NA
1 ½ DN40	1.900 48.3	3.75 95	4.8 2.2	3.75 95	4.8 2.2	NA	NA
2 DN50	2.375 60.3	3.75 95	4.5 2.0	3.75 95	4.5 2.0	NA	NA
x x ¾ DN65 DN65 DN20	3.000 x 3.000 x 1.050 76.1 76.1 26.9	3.75 (sw) 95	+	3.75 (sw) 95	+	NA	NA
1 DN25	1.315 33.7	3.75 (sw) 95	+	3.75 (sw) 95	+	NA	NA
1 ¼ DN32	1.660 42.4	3.75 (sw) 95	+	3.75 (sw) 95	+	NA	NA
1 ½ DN40	1.900 48.3	3.75 (sw) 95	+	3.75 (sw) 95	+	NA	NA
2 DN50	2.375 60.3	3.75 95	4.6 2.1	3.75 95	4.6 2.1	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

2 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(sw) = Carbon Steel Segmentally Welded

NA = Not Available

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NOTES

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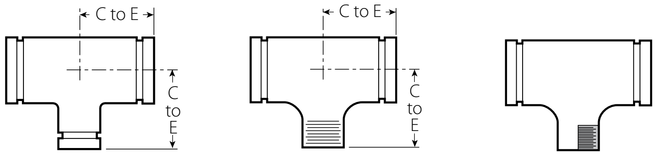
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
3 x 3 x ¾ DN80 DN80 DN20	3.500 x 3.500 x 1.050 88.9 88.9 26.9	4.25 (sw) 108	5.7 2.6	4.25 (sw) 108	5.7 2.6	NA	NA
1 DN25	1.315 33.7	4.25 108	6.0 2.7	4.25 108	6.0 2.7	NA	NA
1¼ DN32	1.660 42.4	4.25 108	6.0 2.7	4.25 108	6.3 2.9	NA	NA
1½ DN40	1.900 48.3	4.25 108	6.6 3.0	4.25 108	6.6 3.0	NA	NA
2 DN50	2.375 60.3	4.25 108	6.2 2.8	4.25 108	6.2 2.8	4.25 108	6.2 2.8
2½	2.875 73.0	4.25 108	6.6 3.0	4.25 108	6.6 3.0	NA	NA
DN65	3.000 76.1	4.25 108	6.8 3.1	4.25 108	11.6 5.3	NA	NA
3½ x 3½ x ¾ DN90 DN90 DN20	4.000 x 4.000 x 1.050 101.6 101.6 26.9	4.50 (sw) 114	+	4.50 (sw) 114	+	NA	NA
1 DN25	1.315 33.7	4.50 (sw) 114	+	4.50 (sw) 114	+	NA	NA
1¼ DN32	1.660 42.4	4.50 (sw) 114	+	4.50 (sw) 114	+	NA	NA
1½ DN40	1.900 48.3	4.50 (sw) 114	+	4.50 (sw) 114	+	NA	NA
2 DN50	2.375 60.3	4.50 (sw) 114	+	4.50 (sw) 114	+	NA	NA
2½	2.875 73.0	4.50 (sw) 114	+	4.50 (sw) 114	+	NA	NA
3 DN80	3.500 88.9	4.50 (sw) 114	+	4.50 (sw) 114	+	NA	NA
	4.250 x 4.250 x 1.050 108.0 108.0 26.9	5.00 (sw) 127	+	5.00 (sw) 127	+	5.00 (sw) 127	+
	1.315 33.7	5.00 (sw) 127	+	5.00 (sw) 127	+	5.00 (sw) 127	+
	1.660 42.4	5.00 (sw) 127	+	5.00 (sw) 127	+	5.00 (sw) 127	+
	1.900 48.3	5.00 (sw) 127	+	5.00 (sw) 127	+	5.00 (sw) 127	+
	2.375 60.3	5.00 (sw) 127	+	5.00 (sw) 127	+	5.00 (sw) 127	+
	3.000 76.1	5.00 (sw) 127	+	5.00 (sw) 127	+	5.00 (sw) 127	+
	3.500 88.9	5.00 127	9.5 4.3	5.00 (sw) 127	+	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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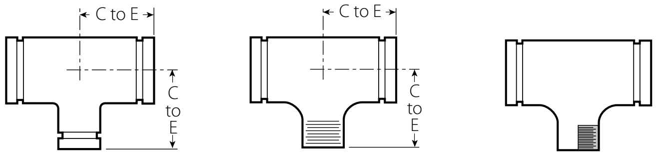
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size						No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN			Actual Outside Diameter inches mm			C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg
4 DN100	x	4 x DN100	¾ DN20	4.500 x 4.500 x 114.3 114.3	1.050 26.9	5.00 (sw) 127	8.0 3.6	5.00 (sw) 127	9.3 4.2	NA	NA
			1 DN25		1.315 33.7	5.00 127	9.1 4.1	5.00 127	9.1 4.1	NA	NA
			1 ¼ DN32		1.660 42.4	5.00 (sw) 127	8.9 4.0	5.00 (sw) 127	10.0 4.5	NA	NA
			1 ½ DN40		1.900 48.3	5.00 127	10.2 4.6	5.00 127	10.2 4.6	NA	NA
			2 DN50		2.375 60.3	5.00 127	11.2 5.1	5.00 127	11.2 5.1	NA	NA
			2 ½		2.875 73.0	5.00 127	11.5 5.2	5.00 127	11.5 5.2	NA	NA
			DN65		3.000 76.1	5.00 127	10.3 4.7	5.00 127	10.3 4.7	NA	NA
			3 DN80		3.500 88.9	5.00 127	11.6 5.3	5.00 127	11.6 5.3	NA	NA
				5.250 x 5.250 x 133.0 133.0	1.050 26.9	5.50 (sw) 140	+	5.50 (sw) 140	+	5.50 (sw) 140	+
					1.315 33.7	5.50 (sw) 140	+	5.50 (sw) 140	+	5.50 (sw) 140	+
					1.660 42.4	5.50 (sw) 140	+	5.50 (sw) 140	+	5.50 (sw) 140	+
					1.900 48.3	5.50 (sw) 140	+	5.50 (sw) 140	+	5.50 (sw) 140	+
					2.375 60.3	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
					3.000 76.1	5.50 (sw) 140	+	5.50 (sw) 140	+	5.50 (sw) 140	+
					3.500 88.9	5.50 (sw) 140	+	5.50 (sw) 140	+	5.50 (sw) 140	+
					4.250 108.0	5.50 140	12.9 5.9	5.50 (sw) 140	+	NA	NA

[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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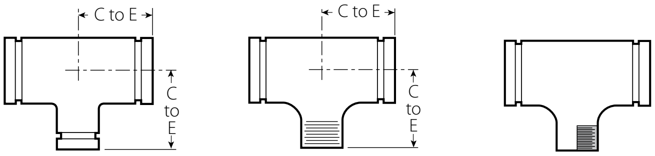
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
x x ¾ DN125 DN125 DN20	5.500 x 5.500 x 1.050 139.7 139.7 26.9	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
1 DN25	1.315 33.7	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
1 ¼ DN32	1.660 42.4	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
1 ½ DN40	1.900 48.3	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
2 DN50	2.375 60.3	5.50 140	13.5 6.1	5.50 (sw) 140	+	NA	NA
DN65	3.000 76.1	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
3 DN80	3.500 88.9	5.50 140	13.8 6.3	5.50 (sw) 140	+	NA	NA
	4.250 108.0	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
4 DN100	4.500 114.3	5.50 140	14.4 6.5	5.50 (sw) 140	+	NA	NA
5 x 5 x ¾ DN20	5.563 x 5.563 x 1.050 141.3 141.3 26.9	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
1 DN25	1.315 33.7	5.50 (sw) 140	14.0 6.4	5.50 (sw) 140	14.0 6.4	NA	NA
1 ¼ DN32	1.660 42.4	5.50 (sw) 140	+	5.50 (sw) 140	+	NA	NA
1 ½ DN40	1.900 48.3	5.50 (sw) 140	14.3 6.5	5.50 (sw) 140	14.5 6.6	NA	NA
2 DN50	2.375 60.3	5.50 (sw) 140	14.5 6.6	5.50 (sw) 140	14.5 6.6	NA	NA
2 ½	2.875 73.0	5.50 140	15.5 7.0	5.50 140	15.8 7.2	NA	NA
3 DN80	3.500 88.9	5.50 140	12.6 5.7	5.50 (sw) 140	17.0 7.7	NA	NA
4 DN100	4.500 114.3	5.50 140	16.0 7.3	5.50 (sw) 140	16.0 7.3	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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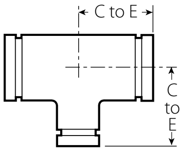
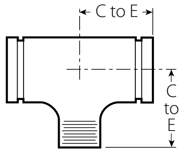
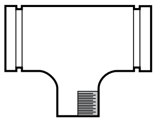
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F







Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
	6.000 x 6.000 x 1.050 152.4 152.4 26.9	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	1.315 33.7	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	1.660 42.4	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	1.900 48.3	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	2.375 60.3	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	3.000 76.1	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	3.500 88.9	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	4.250 108.0	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	4.500 114.3	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	5.250 133.0	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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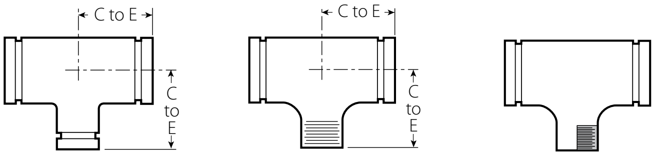
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
	6.250 x 6.250 x 1.050 159.0 159.0 26.9	6.50 (sw) 165	+	6.50 (sw) 165	+	6.50 (sw) 165	+
	1.315 33.7	6.50 (sw) 165	+	6.50 (sw) 165	+	6.50 (sw) 165	+
	1.660 42.4	6.50 (sw) 165	+	6.50 (sw) 165	+	6.50 (sw) 165	+
	1.900 48.3	6.50 (sw) 165	+	6.50 (sw) 165	+	6.50 (sw) 165	+
	2.375 60.3	6.50 (sw) 165	+	6.50 (sw) 165	+	6.50 (sw) 165	+
	3.000 76.1	6.50 (sw) 165	+	6.50 (sw) 165	+	6.50 (sw) 165	+
	3.500 88.9	6.50 165	18.5 8.4	6.50 (sw) 165	+	NA	NA
	4.250 108.0	6.50 165	18.5 8.4	6.50 (sw) 165	+	NA	NA
	4.500 114.3	6.50 165	12.1 5.5	6.50 (sw) 165	+	NA	NA
	5.250 133.0	6.50 165	19.0 8.6	6.50 (sw) 165	+	NA	NA
	6.500 x 6.500 x 1.050 165.1 165.1 26.9	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
	1.315 33.7	6.50 (sw) 165	10.8 4.9	6.50 (sw) 165	10.8 4.9	NA	NA
	1.660 42.4	6.50 (sw) 165	11.0 5.0	6.50 (sw) 165	11.0 5.0	NA	NA
	1.900 48.3	6.50 (sw) 165	11.3 5.1	6.50 (sw) 165	11.3 5.1	NA	NA
	2.375 60.3	6.50 165	18.9 8.6	6.50 165	18.9 8.6	NA	NA
	3.000 76.1	6.50 165	20.0 9.1	6.50 (sw) 165	+	NA	NA
	3.500 88.9	6.50 165	24.3 11.0	6.50 (sw) 165	+	NA	NA
	4.500 114.3	6.50 165	23.8 10.8	6.50 (sw) 165	+	NA	NA
	5.500 139.7	6.50 165	26.0 11.8	6.50 (sw) 165	+	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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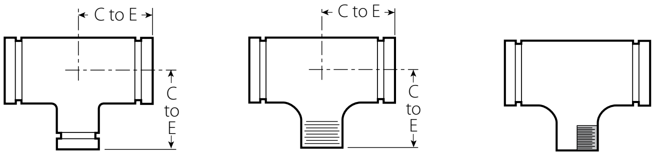
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size						No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN			Actual Outside Diameter inches mm			C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg
6 x DN150	6 x DN150	¾ DN20	6.625 x 168.3	6.625 x 168.3	1.050 26.9	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
		1 DN25			1.315 33.7	6.50 (sw) 165	23.0 10.4	6.50 (sw) 165	23.0 10.4	NA	NA
		1 ¼ DN32			1.660 42.4	6.50 (sw) 165	25.0 11.3	6.50 (sw) 165	25.0 11.3	NA	NA
		1 ½ DN40			1.900 48.3	6.50 (sw) 165	25.0 11.3	6.50 (sw) 165	25.0 11.3	NA	NA
		2 DN50			2.375 60.3	6.50 165	22.8 10.3	6.50 165	22.8 10.3	NA	NA
		2 ½			2.875 73.0	6.50 165	23.8 10.8	6.50 165	25.2 11.4	NA	NA
		DN65			3.000 76.1	6.50 (sw) 165	+	6.50 165	+	NA	NA
		3 DN80			3.500 88.9	6.50 165	24.8 11.2	6.50 165	24.9 11.3	NA	NA
		4 DN100			4.500 114.3	6.50 165	24.8 11.2	6.50 165	22.1 10.0	NA	NA
		DN125			5.500 139.7	6.50 (sw) 165	+	6.50 (sw) 165	+	NA	NA
		5			5.563 141.3	6.50 165	26.7 12.1	6.50 (sw) 165	26.7 12.1	NA	NA
200A x	200A x	65A	216.3 x	216.3 x	76.3	7.75 (sw) 197	+	NA	NA	NA	NA
		100A			114.3	7.75 (sw) 197	+	NA	NA	NA	NA
		165A				7.75 197	50.0 22.7	NA	NA	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

2 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(sw) = Carbon Steel Segmentally Welded

NA = Not Available

"+" = Contact Victaulic for details

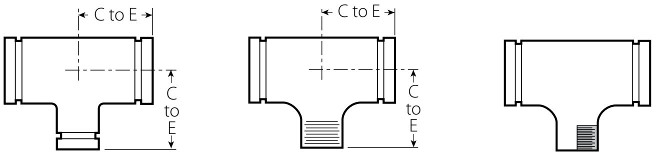
NOTES

- All fittings are ductile iron unless otherwise noted with an (sw).

4.4 DIMENSIONS (CONTINUED)

Reduced Tee

No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	Actual Outside Diameter inches mm	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg
8 x 8 x ¾ DN200 x DN200 x DN20	8.625 x 8.625 x 1.050 219.1 x 219.1 x 26.9	7.75 (sw) 197	+	7.75 (sw) 197	+	7.75 (sw) 197	+
1 DN25	1.315 33.7	7.75 (sw) 197	+	7.75 (sw) 197	+	7.80 (sw) 198	+
1 ¼ DN32	1.660 42.4	7.75 (sw) 197	+	7.75 (sw) 197	+	7.80 (sw) 198	+
1 ½ DN40	1.900 48.3	7.75 (sw) 197	33.0 15.0	7.75 (sw) 197	37.7 17.1	7.80 (sw) 198	+
2 DN50	2.375 60.3	7.75 (sw) 197	33.5 15.2	7.75 (sw) 197	33.5 15.2	NA	NA
2 ½	2.875 73.0	7.75 197	37.3 16.9	7.75 (sw) 197	34.0 15.4	NA	NA
DN65	3.000 76.1	7.75 (sw) 197	37.5 17.0	NA	NA	7.80 (sw) 198	+
3 DN80	3.500 88.9	7.75 197	37.5 17.0	7.75 (sw) 197	33.6 15.2	NA	NA
	4.250 108.0	7.75 197	48.9 22.2	NA	NA	NA	NA
4 DN100	4.500 114.3	7.75 197	42.9 19.5	7.75 (sw) 197	35.0 15.9	NA	NA
	5.250 133.0	9.02 229	54.6 24.8	7.75 (sw) 197	+	NA	NA
DN125	5.500 139.7	7.75 (sw) 197	+	NA	NA	NA	NA
5	5.563 141.3	7.75 197	37.0 16.8	7.75 (sw) 197	37.0 16.8	NA	NA
	6.250 159.0	7.75 197	51.6 23.4	7.75 (sw) 197	+	NA	NA
	6.500 165.1	7.75 197	43.2 19.6	7.75 (sw) 197	+	NA	NA
6 DN150	6.625 168.3	7.75 197	48.5 22.0	7.75 (sw) 197	43.0 19.5	NA	NA
	10.528 10.528 6.500 267.4 267.4 165.1	9.00 229	68.4 31.0	NA	NA	NA	NA
250A x 250A x 4 DN100	267.4 x 267.4 x 4.5 114.3	9.00 (sw) 229	+	NA	NA	NA	NA
125A	139.8	9.00 (sw) 229	+	NA	NA	NA	NA
200A	216.3	9.00 229	82.0 37.2	NA	NA	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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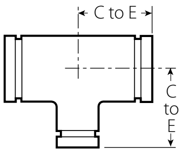
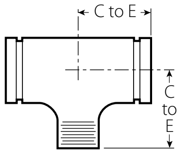
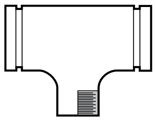
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F







Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	Actual Outside Diameter inches mm	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg
10 x 10 x ¾ DN250 x DN250 x DN20	10.750 x 10.750 x 1.050 273.0 x 273.0 x 26.9	9.00 (sw) 229	+	9.00 (sw) 229	+	NA	NA
1 DN25	1.315 33.7	9.00 (sw) 229	+	9.00 (sw) 229	+	NA	NA
1 ¼ DN32	1.660 42.4	9.00 (sw) 229	+	9.00 (sw) 229	+	NA	NA
1 ½ DN40	1.900 48.3	9.00 (sw) 229	57.0 25.9	9.00 (sw) 229	57.0 25.9	NA	NA
2 DN50	2.375 60.3	9.00 (sw) 229	62.0 28.1	9.00 (sw) 229	65.0 29.5	9.00 (sw) 229	+
2 ½	2.875 73.0	9.00 229	62.5 28.3	9.00 (sw) 229	53.0 24.0	NA	NA
DN65	3.000 76.1	9.00 (sw) 229	71.2 32.3	NA	NA	NA	NA
3 DN80	3.500 88.9	9.00 229	62.1 28.2	9.00 (sw) 229	60.0 27.2	NA	NA
	4.250 108.0	9.02 229	77.6 35.2	9.00 (sw) 229	+	NA	NA
4 DN100	4.500 114.3	9.00 229	61.0 27.7	9.00 (sw) 229	61.0 27.7	NA	NA
	5.250 133.0	9.02 229	84.2 38.2	9.00 (sw) 229	+	NA	NA
DN125	5.500 139.7	9.00 (sw) 229	+	9.00 (sw) 229	+	NA	NA
	6.250 159.0	9.02 229	84.9 38.5	9.00 (sw) 229	+	NA	NA
5	5.563 141.3	9.00 (sw) 229	52.0 23.6	9.00 (sw) 229	52.0 23.6	NA	NA
	6.250 159.0	9.00 229	61.0 27.7	9.00 (sw) 229	+	NA	NA
	6.500 165.1	9.00 229	64.2 29.1	9.00 (sw) 229	+	NA	NA
6 DN150	6.625 168.3	9.00 229	59.0 26.8	9.00 (sw) 229	60.0 27.2	NA	NA
8 DN200	8.625 219.1	9.00 229	64.7 29.3	9.00 (sw) 229	64.7 29.3	NA	NA
300A x 300A x 150A	318.5 x 318.5 x 165.2	10.00 (sw) 254	+	NA	NA	NA	NA
200A	216.3	10.00 (sw) 254	+	NA	NA	NA	NA
250A	267.4	10.00 254	111.0 50.3	NA	NA	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

2 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

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NOTES

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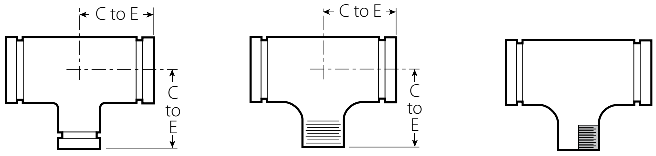
4.4 DIMENSIONS (CONTINUED)

Reducing Tee
No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
12 x 12 x ¾ DN300 DN300 DN20	12.750 x 12.750 x 1.050 323.9 323.9 26.9	10.00 (sw) 254	+	NA	NA	10.00 (sw) 254	+
1 DN25	1.315 33.7	10.00 (sw) 254	70.0 31.8	10.00 (sw) 254	77.0	10.00 (sw) 254	+
1 ¼ DN32	1.660 42.4	10.00 (sw) 254	+	10.00 (sw) 254	+	10.00 (sw) 254	+
1 ½ DN40	1.900 48.3	10.00 (sw) 254	+	10.00 (sw) 254	+	10.00 254	+
2 DN50	2.375 60.3	10.00 (sw) 254	78.0 35.4	10.00 (sw) 254	78.0 35.4	10.00 (sw) 254	+
2 ½	2.875 73.0	10.00 (sw) 254	80.0 36.3	10.00 (sw) 254	80.0 36.3	NA	NA
DN65	3.000 76.1	10.00 (sw) 254	+	10.00 (sw) 254	+	10.00 (sw) 254	+
3 DN80	3.500 88.9	10.00 (sw) 254	80.0 36.3	10.00 (sw) 254	86.5 39.2	NA	NA
	4.250 108.0	10.00 254	+	10.00 (sw) 254	+	NA	NA
4 DN100	4.500 114.3	10.00 (sw) 254	86.7 39.3	10.00 (sw) 254	77.0 34.9	NA	NA
	5.250 133.0	10.00 254	130.0 59.0	10.00 (sw) 254	+	NA	NA
DN125	5.500 139.7	10.00 (sw) 254	81.8 37.1	10.00 (sw) 254	+	NA	NA
5	5.563 141.3	10.00 (sw) 254	75.0 34.0	10.00 (sw) 254	75.0 34.0	NA	NA
	6.250 159.0	10.00 254	125.6 57.0	10.00 (sw) 254	+	NA	NA
	6.500 165.1	10.00 (sw) 254	+	10.00 (sw) 254	+	NA	NA
6 DN150	6.625 168.3	10.00 254	88.5 40.2	10.00 (sw) 254	75.0 34.0	NA	NA
8 DN200	8.625 219.1	10.00 254	80.0 36.3	10.00 (sw) 254	80.0 36.3	NA	NA
10 DN250	10.750 273.0	10.00 254	123.5 56.0	10.00 (sw) 254	84.0 38.1	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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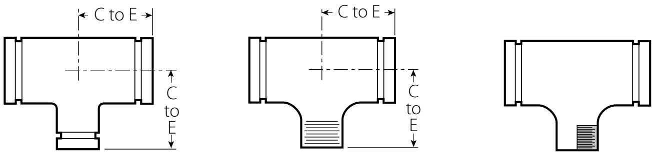
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
14[1] x 14 x 4 DN350 DN350 DN100	14.000 x 14.000 x 4.500 355.6 355.6 114.3	11.00 (sw) 279	102.0 46.3	11.00 (sw) 279	102.0 46.3	NA	NA
6 DN150	6.625 168.3	11.00 (sw) 279	108.2 49.1	11.00 (sw) 279	108.2 49.1	NA	NA
8 DN200	8.625 219.1	11.00 (sw) 279	112.0 50.8	11.00 (sw) 279	112.0 50.8	NA	NA
10 DN250	10.750 273.0	11.00 (sw) 279	120.0 54.4	11.00 (sw) 279	120.0 54.4	NA	NA
12 DN300	12.750 323.9	11.00 (sw) 279	129.1 58.6	11.00 (sw) 279	129.1 58.6	NA	NA
	14.843 14.843 6.500 377.0 377.0 165.1	11.00 279	142.4 64.6	NA	NA	NA	NA
	8.625 219.1	11.00 279	145.5 66.0	NA	NA	NA	NA
	10.750 273.0	11.00 279	149.9 68.0	NA	NA	NA	NA
	12.750 323.9	11.00 279	144.6 65.6	NA	NA	NA	NA
16[1] x 16 x 4 DN400 DN400 DN100	16 x 16 x 4.500 DN400 DN400 114.3	12.00 (sw) 305	130.0 59.0	12.00 (sw) 305	130.0 59.0	NA	NA
6 DN150	6.625 168.3	12.00 (sw) 305	133.5 60.6	12.00 (sw) 305	133.5 60.6	NA	NA
8 DN200	8.625 219.1	12.00 (sw) 305	145.0 65.8	12.00 (sw) 305	145.0 65.8	NA	NA
10 DN250	10.750 273.0	12.00 (sw) 305	149.5 67.8	12.00 (sw) 305	149.5 67.8	NA	NA
12 DN300	12.750 323.9	12.00 (sw) 305	154.0 69.9	12.00 (sw) 305	154.0 69.9	NA	NA
14 DN350	14.000 355.6	12.00 (sw) 305	167.0 75.7	NA	NA	NA	NA
	16.772 x 16.772 x 6.250 426.0 426.0 159.0	12.83 326	189.6 86.0	NA	NA	NA	NA
	8.625 219.1	12.83 326	213.9 97.0	NA	NA	NA	NA
	10.750 273.0	12.83 326	224.9 102.0	NA	NA	NA	NA
	12.750 323.9	12.83 326	224.9 102.0	NA	NA	NA	NA
	14.843 377.0	12.83 326	227.1 103.0	NA	NA	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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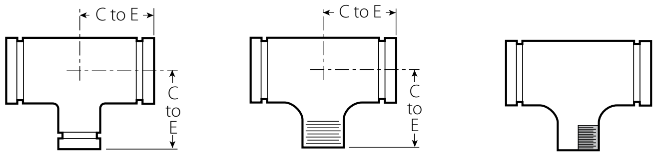
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread² Branch		No. 29F² Reducing Tee Groove x Female Thread² Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
18[1] x 18 x 4 DN450 DN450 DN100	18.000 x 18.000 x 4.500 457.2 457.2 114.3	15.50 (sw) 394	194.0 88.0	15.50 (sw) 394	194.0 88.0	NA	NA
6 DN150	6.625 168.3	15.50 (sw) 394	200.0 90.7	15.50 (sw) 394	200.0 90.7	NA	NA
8 DN200	8.625 219.1	15.50 (sw) 394	202.6 91.9	15.50 (sw) 394	202.0 91.6	NA	NA
10 DN250	10.750 273.0	15.50 (sw) 394	212.0 96.2	15.50 (sw) 394	212.0 96.2	NA	NA
12 DN300	12.750 323.9	15.50 (sw) 394	222.6 101.0	15.50 (sw) 394	222.6 101.0	NA	NA
14 DN350	14.000 355.6	15.50 (sw) 394	230.1 104.4	NA	NA	NA	NA
16 DN400	16 DN400	15.50 (sw) 394	247.6 112.3	NA	NA	NA	NA
	18.898 x 18.898 x 4.250 480.0 480.0 108.0	14.75 375	282.4 128.1	NA	NA	NA	NA
	5.250 133.0	14.75 375	283.0 128.4	NA	NA	NA	NA
	6.250 159.0	14.75 375	283.3 128.5	NA	NA	NA	NA
	10.750 273.0	14.75 375	285.1 129.3	NA	NA	NA	NA
	14.843 377.0	14.75 375	293.8 133.2	NA	NA	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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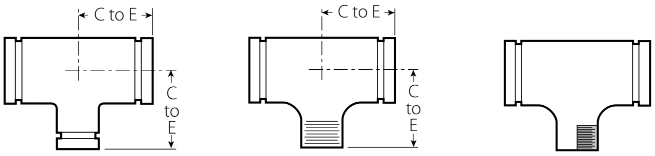
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread² Branch		No. 29F² Reducing Tee Groove x Female Thread² Branch	
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg	**C to E** inches mm	**Approx. Weight (Each)** lb kg
20[1] x 20 x 6 DN500 DN500 DN150	20.000 x 20.000 x 6.625 508.0 508.0 168.3	17.25 (sw) 438	240.0 108.9	17.25 (sw) 438	240.0 108.9	NA	NA
8 DN200	8.625 219.1	17.25 (sw) 438	244.0 110.7	17.25 (sw) 438	244.0 110.7	NA	NA
10 DN250	10.750 273.0	17.25 (sw) 438	256.0 116.1	17.25 (sw) 438	256.0 116.1	NA	NA
12 DN300	12.750 323.9	17.25 (sw) 438	264.3 119.9	17.25 (sw) 438	264.0 119.7	NA	NA
14 DN350	14.000 355.6	17.25 (sw) 438	275.0 124.7	NA	NA	NA	NA
16 DN400	16.000 406.4	17.25 (sw) 438	288.6 130.9	NA	NA	NA	NA
18 DN450	18.000 457.2	17.25 (sw) 438	297.0 134.7	NA	NA	NA	NA
	20.866 x 20.866 x 6.250 530.0 530.0 159.0	17.25 438	368.2 167.0	NA	NA	NA	NA
	8.625 219.1	17.25 438	401.3 182.0	NA	NA	NA	NA
	10.750 273.0	17.25 438	379.2 172.0	NA	NA	NA	NA
	12.750 323.9	17.25 438	401.2 182.0	NA	NA	NA	NA
	14.843 377.0	17.25 438	383.6 174.0	NA	NA	NA	NA
	16.772 426.0	17.25 438	401.2 182.0	NA	NA	NA	NA
	18.898 480.0	17.25 438	399.2 181.1	NA	NA	NA	NA

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

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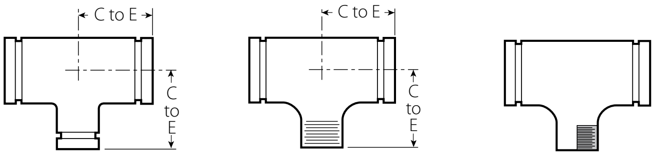
4.4 DIMENSIONS (CONTINUED)

Reducing Tee

No. 25
No. 29T
No. 29F



Size		No. 25 Grooved Branch Reducing Tee		No. 29T Reducing Tee Groove x Male Thread[2] Branch		No. 29F[2] Reducing Tee Groove x Female Thread[2] Branch	
Nominal inches DN	Actual Outside Diameter inches mm	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg	C to E inches mm	Approx. Weight (Each) lb kg
24[1] x 24 x 8 DN600 DN600 DN200	24.000 x 24.000 x 8.625 609.6 609.6 219.1	20.00 (sw) 508	340.0 154.2	20.00 (sw) 508	340.0 154.2	NA	NA
10 DN250	10.750 273.0	20.00 (sw) 508	343.9 156.0	20.00 (sw) 508	343.9 156.0	NA	NA
12 DN300	12.750 323.9	20.00 (sw) 508	352.8 160.0	20.00 (sw) 508	352.8 160.0	NA	NA
14 DN350	14.000 355.6	20.00 508	+	NA	NA	NA	NA
16 DN400	16.000 406.4	20.00 (sw) 508	378.0 171.5	NA	NA	NA	NA
18 DN450	18.000 457.2	20.00 508	+	NA	NA	NA	NA
20 DN500	20.000 508.0	20.00 (sw) 508	400.0 181.4	NA	NA	NA	NA
	24.803 x 24.803 x 6.250 630.0 630.0 159.0	20.00 508	559.2 253.6	NA	NA	NA	NA
	8.625 219.1	20.00 508	559.2 253.6	NA	NA	NA	NA
	10.750 273.0	20.00 508	562.2 255.0	NA	NA	NA	NA
	12.750 323.9	20.00 508	562.2 255.0	NA	NA	NA	NA
	14.843 377.0	20.00 508	586.4 266.0	NA	NA	NA	NA
	16.772 426.0	20.00 508	579.8 263.0	NA	NA	NA	NA
	18.898 480.0	20.00 508	568.8 258.0	NA	NA	NA	NA
	20.866 530.0	20.00 508	574.3 260.5	NA	NA	NA	NA
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05						

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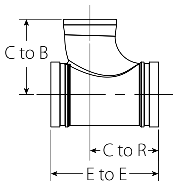
- All fittings are ductile iron unless otherwise noted with an (sw).

4.5 DIMENSIONS (CONTINUED)

Pitcher Tee

No. 29P



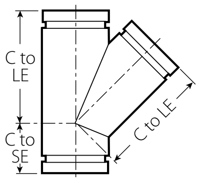
Size						No. 29P Pitcher Tee Groove x Female Thread Branch			
Nominal inches DN			Actual Outside Diameter inches mm			C to R inches mm	E to E inches mm	C to B inches mm	Approx. Weight (Each) lb kg
4 x DN100	4 x DN100	2½	4.500 x 114.3	4.500 x 114.3	2.875 73.0	4.75 121	7.50 191	5.25 133	10.1 4.6

NOTE
- All fittings are ductile iron unless otherwise noted with an (sw).

4.6 DIMENSIONS

45° Lateral

No. 30



Size		No. 30 45° Lateral		
Nominal inches DN	Actual Outside Diameter inches mm	C to LE inches mm	C to SE inches mm	Approx. Weight (Each) lb kg
¾ DN20	1.050 26.9	4.50 (sw) 114	2.00 (sw) 51	0.9 0.4
1 DN25	1.315 33.7	5.00 (sw) 127	2.25 (sw) 57	1.7 0.8
1 ¼ DN32	1.660 42.4	5.75 (sw) 146	2.50 (sw) 64	2.5 1.1
1 ½ DN40	1.900 48.3	6.25 (sw) 159	2.75 (sw) 70	3.5 1.6
2 DN50	2.375 60.3	7.00 (sw) 178	2.75 (sw) 70	5.1 2.3
2 ½	2.875 73.0	7.75 (sw) 197	3.00 (sw) 76	9.0 4.1
DN65	3.000 76.1	8.50 (sw) 216	3.25 (sw) 83	9.8 4.4
3 DN80	3.500 88.9	8.50 216	3.25 83	10.3 4.6
3 ½ DN90	4.000 101.6	10.00 (sw) 254	3.50 (sw) 89	22.0 10.0
	4.250 108.0	10.50 (sw) 267	3.75 (sw) 95	22.1 10.0
4 DN100	4.500 114.3	10.50 267	3.75 95	17.9 8.1
4 ½	5.000 127.0	12.50 (sw) 318	4.00 (sw) 102	23.8 10.8
	5.250 133.0	12.50 (sw) 318	4.00 (sw) 102	25.3 11.5
DN125	5.500 139.7	12.50 (sw) 318	4.00 (sw) 102	26.8 12.1
5	5.563 141.3	12.50 (sw) 318	4.00 (sw) 102	29.8 13.5
	6.000 152.4	14.00 (sw) 356	4.50 (sw) 114	33.8 15.3
	6.250 159.0	14.00 (sw) 356	4.50 (sw) 114	36.8 16.7
	6.500 165.1	14.00 (sw) 356	4.50 (sw) 114	43.6 19.8
6 DN150	6.625 168.3	14.00 356	4.50 114	43.6 19.8

[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

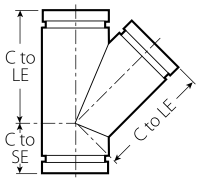
NOTE

- All fittings are ductile iron unless otherwise noted with an (sw).

4.6 DIMENSIONS (CONTINUED)

45° Lateral

No. 30



Size		No. 30 45° Lateral		
Nominal inches DN	**Actual Outside Diameter** inches mm	**C to LE** inches mm	**C to SE** inches mm	**Approx. Weight (Each)** lb kg
8 DN200	8.625 219.1	18.00 (sw) 457	6.00 (sw) 152	73.0 33.1
10 DN250	10.750 273.0	20.50 (sw) 521	6.50 (sw) 165	105.0 47.6
12 DN300	12.750 323.9	23.00 (sw) 584	7.00 (sw) 178	165.0 74.8
14[1] DN350	14.000 355.6	26.50 (sw) 673	7.50 (sw) 191	276.0 125.2
16[1] DN400	16.000 406.4	29.00 (sw) 737	8.00 (sw) 203	344.2 156.1
18[1] DN450	18.000 457.2	32.00 (sw) 813	8.50 (sw) 216	429.0 194.6
20[1] DN500	20.000 508.0	35.00 (sw) 889	9.00 (sw) 229	500.0 226.8
22[1] DN550	22.000 558.8	38.00 (sw) 965	9.50 (sw) 241	610.0 276.7
24[1] DN600	24.000 609.6	40.00 (sw) 1016	10.00 (sw) 254	715.0 324.3

[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

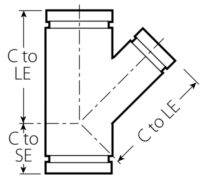
NOTE

- All fittings are ductile iron unless otherwise noted with an (sw).

4.7 DIMENSIONS

45° Reducing Lateral

No. 30-R SWS



Size										No. 30-R SWS 45° Reducing Lateral (sw)		
Nominal inches DN					Actual Outside Diameter inches DN					C to LE inches mm	C to SE inches mm	Approx. Weight (Each) lb kg
3 DN80	x	3 DN80	x	2 DN50	3.500 88.9	x	3.500 88.9	x	2.375 60.3	8.50 216	3.25 83	9.8 4.4
				2½					2.875 73.0	8.50 216	3.25 83	9.8 4.4
4 DN100	x	4 DN100	x	2 DN50	4.500 114.3	x	4.500 114.3	x	2.375 60.3	10.50 267	3.75 95	10.0 4.5
				2½					2.875 73.0	10.50 267	3.75 95	10.0 4.5
				3 DN80					3.500 88.9	10.50 267	3.75 95	18.3 8.3
5	x	5	x	2 DN50	5	x	5	x	2.375 60.3	12.50 318	4.00 102	24.0 10.9
				3 DN80					3.500 88.9	12.50 318	4.00 102	27.0 12.2
				4 DN100					4.500 114.3	12.50 318	4.00 102	26.5 12.0
6 DN150	x	6 DN150	x	3 DN80	6.625 168.3	x	6.625 168.3	x	3.500 88.9	14.00 356	4.50 114	37.0 16.8
				4 DN100					4.500 114.3	14.00 356	4.50 114	36.0 16.3
				5					5.563 141.3	14.00 356	4.50 114	44.7 20.3
8 DN200	x	8 DN200	x	3 DN80	8.625 219.1	x	8.625 219.1	x	3.500 88.9	18.00 457	6.00 152	58.0 26.3
				4 DN100					4.500 114.3	18.00 457	6.00 152	62.0 28.1
				5					5.563 141.3	18.00 457	6.00 152	75.5 34.2
				6 DN150					6.625 168.3	18.00 457	6.00 152	82.0 37.2
10 DN250	x	10 DN250	x	4 DN100	10.750 273.0	x	10.750 273.0	x	4.500 114.3	20.50 521	6.50 165	104.8 47.5
				5					5.563 141.3	20.50 521	6.50 165	105.0 47.6
				6 DN150					6.625 168.3	20.50 521	6.50 165	105.8 48.0
				8 DN200					8.625 219.1	20.50 521	6.50 165	118.0 53.5
12 DN300	x	12 DN300	x	4 DN100	12.750 323.9	x	12.750 323.9	x	4.500 114.3	23.00 584	7.00 178	135.0 61.2
				5					5.563 141.3	23.00 584	7.00 178	122.0 55.3
				6 DN150					6.625 168.3	23.00 584	7.00 178	137.0 62.1
				8 DN200					8.625 219.1	23.00 584	7.00 178	147.0 66.7
				10 DN250					10.750 273.0	23.00 584	7.00 178	167.0 75.7

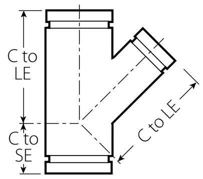
[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

4.7 DIMENSIONS (CONTINUED)

45° Reducing Lateral

No. 30-R SWS



Size										No. 30-R SWS 45° Reducing Lateral (sw)		
Nominal inches DN					**Actual Outside Diameter** inches DN					**C to LE** inches mm	**C to SE** inches mm	**Approx. Weight (Each)** lb kg
14[1] DN350	x	14 DN350	x	4 DN100	14.000 355.6	x	14.000 355.6	x	4.500 114.3	26.50 673	7.50 191	176.0 79.8
				6 DN150					6.625 168.3	26.50 673	7.50 191	187.0 84.8
				8 DN200					8.625 219.1	26.50 673	7.50 191	210.0 95.3
				10 DN250					10.750 273.0	26.50 673	7.50 191	235.0 106.6
				12 DN300					12.750 323.9	26.50 673	7.50 191	252.0 114.3
16[1] DN400	x	16 DN400	x	6 DN150	16.000 406.4	x	16.000 406.4	x	6.625 168.3	29.00 737	8.00 203	215.0 97.5
				8 DN200					8.625 219.1	29.00 737	8.00 203	252.5 114.5
				10 DN250					10.750 273.0	29.00 737	8.00 203	265.0 120.2
				12 DN300					12.750 323.9	29.00 737	8.00 203	295.0 133.8
				14 DN350					16.000 406.4	29.00 737	8.00 203	305.0 138.3
18[1] DN450	x	18 DN450	x	6 DN150	18.000 457.2	x	18.000 457.2	x	6.625 168.3	32.00 813	8.50 216	274.0 124.3
				8 DN200					8.625 219.1	32.00 813	8.50 216	275.0 124.7
				10 DN250					10.750 273.0	32.00 813	8.50 216	285.0 129.3
				12 DN300					12.750 323.9	32.00 813	8.50 216	347.0 157.4
				14 DN350					14.000 355.6	32.00 813	8.50 216	350.0 158.8
				16 DN400					16.000 406.4	32.00 813	8.50 216	362.0 164.2
20[1] DN500	x	20 DN500	x	10 DN250	20.000 508.0	x	20.000 508.0	x	10.750 273.0	35.00 889	9.00 229	410.0 186.0
				12 DN300					12.750 323.9	35.00 889	9.00 229	415.0 188.2
				14 DN350					14.000 355.6	35.00 889	9.00 229	420.0 190.5
				16 DN400					16.000 406.4	35.00 889	9.00 229	425.0 192.8
24[1] DN600	x	24 DN600	x	16 DN400	24.000 609.6	x	24.000 609.6	x	16.000 406.4	40.00 1016	10.00 254	556.0 252.2
				20 DN500					20.000 508.0	40.00 1016	10.00 254	715.0 324.3
14 – 60 DN350 – DN1500					For AGS fitting information, see publication 20.05 AGS™							

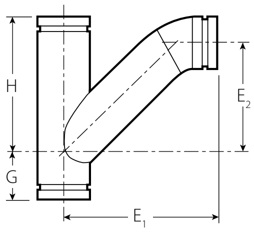
[1] For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(sw) = Carbon Steel Segmentally Welded

4.8 DIMENSIONS

Tee Wye

No. 32



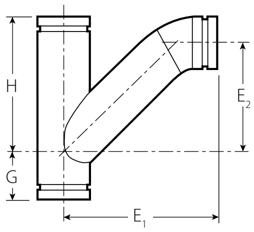
Size		No. 32 Tee Wye (sw)				
Nominal inches DN	**Actual Outside Diameter** inches mm	**G** inches mm	**H** inches mm	**E1** inches mm	**E2** inches mm	**Approx. Weight (Each)** lb kg
2 x 2 x 2 DN50 DN50 DN50	2.375 x 2.375 x 2.375 60.3 60.3 60.3	2.75 70	7.00 178	9.00 229	4.63 117	6.4 2.9
2½ x 2½ x 2½	2.875 x 2.875 x 2.875 73.0 73.0 73.0	3.00 76	7.75 197	10.50 267	5.75 146	11.5 5.2
3 x 3 x 2 DN80 DN80 DN50	3.500 x 3.500 x 2.375 88.9 88.9 60.3	3.25 83	8.50 216	10.38 264	6.00 152	12.5 5.7
3 DN80	3.500 88.9	3.25 83	8.50 216	11.50 292	6.50 165	14.3 6.5
3½ x 3½ x 3½ DN90 DN90 DN90	4.000 x 4.000 x 4.000 101.6 101.6 101.6	3.25 83	10.00 254	13.00 330	7.75 197	15.0 6.8
4 x 4 x 1 DN100 DN100 DN25	4.500 x 4.500 x 1.315 114.3 114.3 33.7	3.75 95	10.50 267	12.25 311	8.38 213	17.0 7.7
2 DN50	2.375 60.3	3.75 95	10.50 267	11.88 302	7.50 191	20.0 9.1
3 DN80	3.500 88.9	3.75 95	10.50 267	12.88 327	7.88 200	23.0 10.4
4 DN100	4.500 114.3	3.75 95	10.00 254	13.63 346	8.13 206	26.0 11.8
5 x 5 x 2 DN50	5.563 x 5.563 x 2.375 141.3 141.3 60.3	4.00 102	12.50 318	13.13 333	8.75 222	29.0 13.2
3 DN80	3.500 88.9	4.00 102	12.50 318	14.25 362	9.25 235	31.5 14.3
4 DN100	4.500 114.3	4.00 102	12.50 318	15.13 384	9.63 244	36.7 16.6
5	5.563 141.3	4.00 102	12.50 318	16.13 410	10.00 254	48.0 21.8
6 x 6 x 2 DN150 DN150 DN50	6.625 x 6.625 x 2.375 168.3 168.3 60.3	4.50 114	14.00 356	14.13 359	9.75 248	29.0 13.2
3 DN80	3.500 88.9	4.50 114	14.00 356	15.31 389	10.31 262	37.3 16.9
4 DN100	4.500 114.3	4.50 114	14.00 356	16.25 413	10.75 273	46.3 21.0
5	5.563 141.3	4.50 114	14.00 356	17.25 438	11.13 283	55.0 25.0
6 DN150	6.625 168.3	4.50 114	14.00 356	18.25 464	11.50 292	60.5 27.4
8 x 8 x 2 DN200 DN200 DN50	8.625 x 8.625 x 2.375 219.1 219.1 60.3	6.00 152	18.00 457	17.00 432	12.63 321	70.0 31.8
3 DN80	3.500 88.9	6.00 152	18.00 457	18.19 462	13.19 335	76.0 34.5
4 DN100	4.500 114.3	6.00 152	18.00 457	19.00 483	13.50 343	76.4 34.6
5	5.563 141.3	6.00 152	18.00 457	20.00 508	13.88 352	85.6 38.8
6 DN150	6.625 168.3	6.00 152	18.00 457	21.13 537	14.38 365	112.0 50.8
8 DN200	8.625 219.1	6.00 152	18.00 457	23.25 591	15.25 387	127.9 58.0

(sw) = Carbon Steel Segmentally Welded

4.8 DIMENSIONS

Tee Wye

No. 32



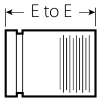
Size		No. 32 Tee Wye (sw)				
Nominal inches DN	**Actual Outside Diameter** inches mm	**G** inches mm	**H** inches mm	**E1** inches mm	**E2** inches mm	**Approx. Weight (Each)** lb kg
10 x 10 x 2 DN250 DN250 DN50	10.750 x 10.750 x 2.375 273.0 273.0 60.3	6.50 165	20.50 521	18.75 476	14.38 365	90.0 40.8
3 DN80	3.500 88.9	6.50 165	20.50 521	19.88 505	14.88 378	96.0 43.5
4 DN100	4.500 114.3	6.50 165	20.50 521	20.75 527	15.25 387	97.4 44.2
5	5.563 141.3	6.50 165	20.50 521	21.88 556	15.75 400	115.0 52.2
6 DN150	6.625 168.3	6.50 165	20.50 521	22.88 581	16.13 410	133.1 60.4
8 DN200	8.625 219.1	6.50 165	20.50 521	27.25 692	19.25 489	156.0 70.8
10 DN250	10.750 273.0	6.50 165	20.50 521	27.25 692	18.00 457	190.0 86.2
12 x 12 x 2 DN300 DN300 DN50	12.750 x 12.750 x 2.375 323.9 323.9 60.3	7.00 178	23.00 584	20.75 527	16.38 416	120.0 54.4
3 DN80	3.500 88.9	7.00 178	23.00 584	21.75 552	16.75 425	125.0 56.7
4 DN100	4.500 114.3	7.00 178	23.00 584	22.63 575	17.13 435	127.0 57.6
5	5.563 141.3	7.00 178	23.00 584	23.63 600	17.50 445	143.0 64.9
6 DN150	6.625 168.3	7.00 178	23.00 584	24.78 629	18.03 458	165.0 74.8
8 DN200	8.625 219.1	7.00 178	23.00 584	26.92 684	18.92 481	176.0 79.8
10 DN250	10.750 273.0	7.00 178	23.00 584	29.00 737	19.75 502	200.0 90.7
12 DN300	12.750 323.9	7.00 178	23.00 584	31.00 787	20.50 521	240.0 108.9

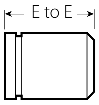
(sw) = Carbon Steel Segmentally Welded

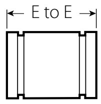
4.9 DIMENSIONS

Adapter Nipple

No. 40
No. 42
No. 43







Size		No. 40 Adapter Nipple Groove x Male Thread² (s)		No. 42 Adapter Nipple Groove x Bevel (s)		No. 43 Adapter Nipple Groove x Groove (s)	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	3.00 76	0.3 0.1	3.00 76	0.3 0.1	3.00 76	0.3 0.1
1 DN25	1.315 33.7	3.00 76	0.4 0.2	3.00 76	0.4 0.2	3.00 76	0.4 0.2
1¼ DN32	1.660 42.4	4.00 102	0.8 0.3	4.00 102	0.8 0.3	4.00 102	0.8 0.3
1½ DN40	1.900 48.3	4.00 102	0.9 0.4	4.00 102	0.9 0.4	4.00 102	0.9 0.4
2 DN50	2.375 60.3	4.00 102	1.2 0.6	4.00 102	1.2 0.6	4.00 102	1.2 0.6
2½	2.875 73.0	4.00 102	1.9 0.9	4.00 102	1.9 0.9	4.00 102	1.9 0.9
DN65	3.000 76.1	4.00 102	2.0 0.9	4.00 102	2.0 0.9	4.00 102	2.0 0.9
3 DN80	3.500 88.9	4.00 102	2.5 1.1	4.00 102	2.5 1.1	4.00 102	2.5 1.1
3½ DN90	4.000 101.6	4.00 102	3.0 1.4	4.00 102	3.0 1.4	4.00 102	3.0 1.4
	4.250 108.0	6.00 152	4.9 2.2	6.00 152	4.9 2.2	6.00 152	4.9 2.2
4 DN100	4.500 114.3	6.00 152	5.4 2.5	6.00 152	5.4 2.5	6.00 152	5.4 2.5
4½	5.000 127.0	6.00 152	6.3 2.8	6.00 152	6.3 2.8	6.00 152	6.3 2.8
	5.250 133.0	6.00 152	6.9 3.1	6.00 152	6.9 3.1	6.00 152	6.9 3.1
DN125	5.500 139.7	6.00 152	7.2 3.3	6.00 152	7.2 3.3	6.00 152	7.2 3.3
5	5.563 141.3	6.00 152	7.3 3.3	6.00 152	7.3 3.3	6.00 152	7.3 3.3
	6.000 152.4	6.00 152	8.6 3.9	6.00 152	8.6 3.9	6.00 152	8.6 3.9
	6.250 159.0	6.00 152	9.0 4.1	6.00 152	9.0 4.1	6.00 152	9.0 4.1
	6.500 165.1	6.00 152	9.3 4.2	6.00 152	9.3 4.2	6.00 152	9.3 4.2
6 DN150	6.625 168.3	6.00 152	9.5 4.3	6.00 152	9.5 4.3	6.00 152	9.5 4.3
8 DN200	8.625 219.1	6.00 152	14.3 6.5	6.00 152	14.3 6.5	6.00 152	14.3 6.5
10 DN250	10.750 273.0	8.00 203	22.8 10.3	8.00 203	22.8 10.3	8.00 203	22.8 10.3
12 DN300	12.750 323.9	8.00 203	33.1 15.0	8.00 203	33.1 15.0	8.00 203	33.1 15.0

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

2 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(s) = Carbon Steel Segmentally Welded

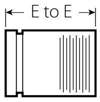
NOTE

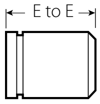
- For pump package nipples with 1 ½"/40mm hole cut to receive Style 923 Vic-Let or Style 924 Vic-O-Well request special No. 40, 42 or 43 nipples and specify No. 40-H, 42-H or 43-H on order. Note: 4 – 12"/DN100 – N300 diameter – 8"/200mm length required.

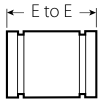
4.9 DIMENSIONS (CONTINUED)

Adapter Nipple

No. 40
No. 42
No. 43







Size		No. 40 Adapter Nipple Groove x Male Thread² (s)		No. 42 Adapter Nipple Groove x Bevel (s)		No. 43 Adapter Nipple Groove x Groove (s)	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
14[1] DN350	14.000 355.6	8.00 203	36.5 16.5	8.00 203	36.5 16.5	8.00 203	36.5 16.5
16[1] DN400	16.000 406.4	8.00 203	41.8 19.0	8.00 203	41.8 19.0	8.00 203	41.8 19.0
18[1] DN450	18.000 457.2	8.00 203	47.2 21.4	8.00 203	47.2 21.4	8.00 203	47.2 21.4
20[1] DN500	20.000 508.0	8.00 203	52.5 23.8	8.00 203	52.5 23.8	8.00 203	52.5 23.8
22[1] DN550	22.000 558.8	8.00 203	57.9 26.3	8.00 203	57.9 26.3	8.00 203	57.9 26.3
24[1] DN600	24.000 609.6	8.00 203	63.2 28.7	8.00 203	63.2 28.7	8.00 203	63.2 28.7
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05 AGS™						

1 For 14"/DN350 and larger roll grooved systems for carbon steel pipe, Victaulic offers fittings for the Advanced Groove System (AGS). Refer to publication 20.05 for more information. For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

2 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(s) = Carbon Steel Segmentally Welded

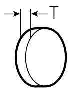
NOTE

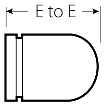
- For pump package nipples with 1 ½"/40mm hole cut to receive Style 923 Vic-Let or Style 924 Vic-O-Well request special No. 40, 42 or 43 nipples and specify No. 40-H, 42-H or 43-H on order. Note: 4 – 12"/DN100 – N300 diameter – 8"/200mm length required.

4.10 DIMENSIONS

Cap
No. 60

Bull Plug
No. 61





Size		No. 60 Cap		No. 61 Bull Plug (s)	
Nominal inches DN	**Actual Outside Diameter** inches mm	**T** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	0.91 (s) 23	0.2 0.1	NA	NA
1 DN25	1.315 33.7	0.79 20	0.2 0.1	NA	NA
1 ¼ DN32	1.660 42.4	0.79 20	0.4 0.2	NA	NA
1 ½ DN40	1.900 48.3	0.79 20	0.4 0.2	NA	NA
2 DN50	2.375 60.3	0.88 22	0.7 0.3	4.00 102	2.6 1.2
2 ½	2.875 73.0	0.88 22	1.2 0.5	5.00 127	3.0 1.4
DN65	3.000 76.1	0.88 22	1.2 0.5	NA	NA
3 DN80	3.500 88.9	0.88 22	1.7 0.7	6.00 152	4.5 2.0
3 ½ DN90	4.000 101.6	0.88 22	1.9 0.9	NA	NA
	4.250 108.0	0.92 23	2.6 1.2	NA	NA
4 DN100	4.500 114.3	0.92 23	3.1 1.4	7.00 178	7.5 3.4
4 ½	5.000 127.0	1.00 (s) 25	5.4 2.4	NA	NA
	5.250 133.0	0.92 23	3.9 1.8	NA	NA
DN125	5.500 139.7	0.92 23	4.5 2.0	NA	NA
5	5.563 141.3	0.92 23	4.9 2.2	8.00 203	11.5 5.2
	6.250 159.0	0.92 23	5.7 2.6	NA	NA
	6.500 165.1	0.92 23	6.2 2.8	NA	NA
6 DN150	6.625 168.3	0.92 23	6.4 2.9	10.00 254	18.0 8.2
200A	216.3	1.13 29	17.4 7.9	NA	NA

[1] For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

"+" = Contact Victaulic for details

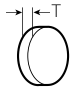
NOTES

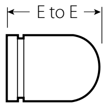
- All fittings are ductile iron unless otherwise noted with an (s).
- No. 60 cap is not suitable for use in vacuum service with Style 72 or Style 750 couplings. No. 61 bull plugs should be used.
- Steel dish caps available through 24"/DN600, contact Victaulic.
- No. 60 Caps are available with taps. Tap sizes range from ½" up to 4" maximum, depending on the diameter of the cap, and can be provided centered or offset to suit the application. Contact Victaulic for pricing and availability. All tapped caps are non-cancellable and non-returnable.

4.10 DIMENSIONS

Cap
No. 60

Bull Plug
No. 61





Size		No. 60 Cap		No. 61 Bull Plug (s)	
Nominal inches DN	Actual Outside Diameter inches mm	T inches mm	Approx. Weight (Each) lb kg	E to E inches mm	Approx. Weight (Each) lb kg
8 DN200	8.625 219.1	1.13 29	13.6 6.2	12.00 305	29.0 13.2
10 DN250	10.750 273.0	1.13 29	23.6 10.7	10.00 254	39.0 17.7
12 DN300	12.750 323.9	1.25 32	38.5 17.5	NA	NA
14[1] DN350	14.000 355.6	9.50 (s) 241	42.0 19.1	NA	NA
16[1] DN400	16.000 406.4	10.00 (s) 254	45.0 20.4	NA	NA
18[1] DN450	18.000 457.2	11.00 (s) 279	58.0 26.3	NA	NA
20[1] DN500	20.000 508.0	12.00 (s) 305	67.5 30.6	NA	NA
22[1] DN550	22.000 558.8	13.00 (s) 330	+	NA	NA
24[1] DN600	24.000 609.6	13.50 (s) 343	105.0 47.6	NA	NA
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05 AGS™				

[1] For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

"+" = Contact Victaulic for details

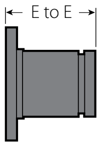
NOTES

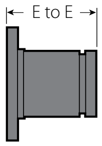
- All fittings are ductile iron unless otherwise noted with an (s).
- No. 60 cap is not suitable for use in vacuum service with Style 72 or Style 750 couplings. No. 61 bull plugs should be used.
- Steel dish caps available through 24"/DN600, contact Victaulic.
- No. 60 Caps are available with taps. Tap sizes range from ½" up to 4" maximum, depending on the diameter of the cap, and can be provided centered or offset to suit the application. Contact Victaulic for pricing and availability. All tapped caps are non-cancellable and non-returnable.

4.11 DIMENSIONS

Flanged Adapter Nipple

No. 41





Size		No. 41 ANSI Class 125 Flange Adapter Nipple Flat Face (s)		No. 41-DN PN10/16 Flange Adapter Nipple Flat Face (s)	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	3.00 76	+	NA	NA
1 DN25	1.315 33.7	3.00 76	2.0 0.9	3.00 76	2.6 1.2
1¼ DN32	1.660 42.4	4.00 102	3.0 1.4	3.00 76	4.1 1.9
1½ DN40	1.900 48.3	4.00 102	3.5 1.6	NA	NA
2 DN50	2.375 60.3	4.00 102	5.5 2.5	4.00 102	6.2 2.8
2½	2.875 73.0	4.00 102	8.0 3.6	NA	NA
DN65	3.000 76.1	NA	NA	4.00 102	7.1 3.2
3 DN80	3.500 88.9	4.00 102	9.5 4.3	4.00 102	9.0 4.1
3½ DN90	4.000 101.6	4.00 102	+	NA	NA
	4.250 108.0	NA	NA	NA	NA
4 DN100	4.500 114.3	6.00 152	16.7 7.6	6.00 152	12.8 5.8
4½	5.000 127.0	NA	NA	NA	NA
	5.250 133.0	NA	NA	NA	NA
DN125	5.500 139.7	NA	NA	6.00 152	16.8 7.6
5	5.563 141.3	6.00 152	21.5 9.8	NA	NA
	6.500 165.1	NA	NA	NA	NA
6 DN150	6.625 168.3	6.00 152	26.5 12.0	6.00 152	20.5 9.3
200A	216.3	NA	NA	NA	NA

[1] For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

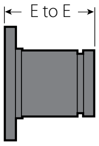
NA = Not Available

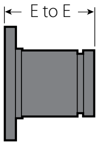
"+" = Contact Victaulic for details

4.11 DIMENSIONS (CONTINUED)

Flanged Adapter Nipple

No. 41





Size		No. 41 ANSI Class 125 Flange Adapter Nipple Flat Face (s)		No. 41-DN PN10/16 Flange Adapter Nipple Flat Face (s)	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
8 DN200	8.625 219.1	6.00 152	39.0 17.7	6.00 152	30.8 14.0
250A	267.4	NA	NA	NA	NA
10 DN250	10.750 273.0	8.00 203	64.2 29.1	8.00 203	46.3 21.0
300A	318.5	NA	NA	NA	NA
12 DN300	12.750 323.9	8.00 203	87.0 39.5	8.00 203	58.7 26.6

[1] For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

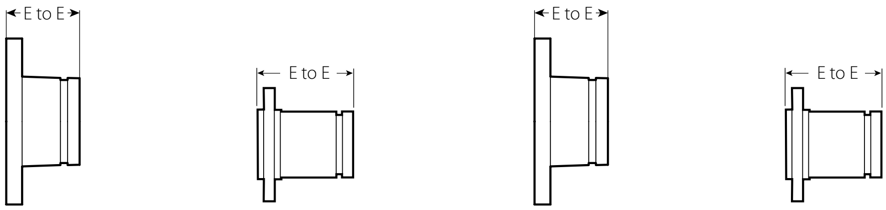
NA = Not Available

"+" = Contact Victaulic for details

4.11 DIMENSIONS (CONTINUED)

Flanged Adapter Nipple

No. 45F
No. 45R
No. 45FE
No. 45RE



Size		No. 45F ANSI Class 150 Flange Adapter Nipple Flat Face		No. 45R ANSI Class 150 Flange Adapter Nipple Raised Face		No. 45FE PN10/16 Flange Adapter Nipple Flat Face		No. 45RE PN10/16 Flange Adapter Nipple Raised Face	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	3.00 (s) 76	2.0 0.9	3.00 (s) 76	2.0 0.9	NA	NA	NA	NA
1 DN25	1.315 33.7	3.00 (s) 76	2.7 1.2	3.00 (s) 76	2.7 1.2	NA	NA	NA	NA
1 ¼ DN32	1.660 42.4	4.00 (s) 102	3.6 1.6	4.00 (s) 102	3.6 1.6	NA	NA	NA	NA
1 ½ DN40	1.900 48.3	4.00 (s) 102	3.9 1.8	4.00 (s) 102	3.9 1.8	2.52 64	+	2.52 64	+
2 DN50	2.375 60.3	4.00 102	6.0 2.7	4.00 102	6.0 2.7	2.52 64	+	2.52 64	+
2 ½	2.875 73.0	4.00 102	9.9 4.5	4.00 102	9.9 4.5	NA	NA	NA	NA
DN65	3.000 76.1	NA	NA	NA	NA	2.52 64	+	2.52 64	+
3 DN80	3.500 88.9	4.00 102	11.7 5.3	4.00 102	11.7 5.3	2.52 64	+	2.52 64	+
3 ½ DN90	4.000 101.6	4.00 (s) 102	13.8 6.3	4.00 (s) 102	13.8 6.3	NA	NA	NA	NA
	4.250 108.0	NA	NA	NA	NA	NA	NA	NA	NA
4 DN100	4.500 114.3	6.00 152	18.5 8.4	6.00 152	18.5 8.4	2.76 70	+	2.76 70	+
DN125	5.500 139.7	NA	NA	NA	NA	2.76 70	+	2.76 70	+
5	5.563 141.3	6.00 (s) 152	21.4 9.7	6.00 (s) 152	21.4 9.7	NA	NA	NA	NA
	6.500 165.1	NA	NA	NA	NA	2.76 70	+	2.76 70	+
6 DN150	6.625 168.3	6.00 152	29.0 13.2	6.00 152	29.0 13.2	2.76 70	+	2.76 70	+
8 DN200	8.625 219.1	6.00 152	42.0 19.1	6.00 152	42.0 19.1	3.15 80	+	3.15 80	+
10 DN250	10.750 273.0	8.00 203	64.2 29.1	8.00 203	64.2 29.1	3.15 80	+	3.15 80	+
12 DN300	12.750 323.9	8.00 203	88.2 40.0	8.00 203	88.2 40.0	3.15 80	+	3.15 80	+
14[1] DN350	14.000 355.6	8.00 (s) 203	126.4 57.3	8.00 203	126.4 57.3	NA	NA	NA	NA
16[1] DN400	16.000 406.4	8.00 (s) 203	150.0 68.0	8.00 203	150.0 68.0	NA	NA	NA	NA

1 For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

"+" = Contact Victaulic for details

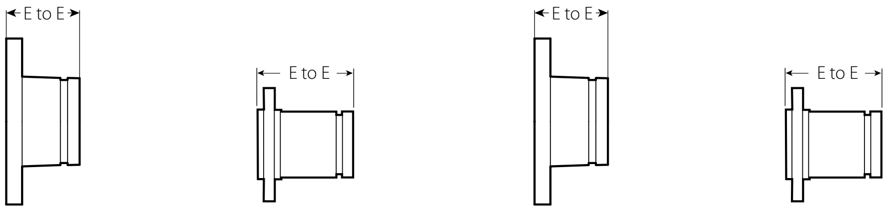
NOTE

- All fittings are ductile iron unless otherwise noted with an (s).

4.11 DIMENSIONS (CONTINUED)

Flanged Adapter Nipple

No. 45F
No. 45R
No. 45FE
No. 45RE



Size		No. 45F ANSI Class 150 Flange Adapter Nipple Flat Face		No. 45R ANSI Class 150 Flange Adapter Nipple Raised Face		No. 45FE PN10/16 Flange Adapter Nipple Flat Face		No. 45RE PN10/16 Flange Adapter Nipple Raised Face	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
18[1] DN450	18.000 457.2	8.00 (s) 203	177.0 80.3	8.00 (s) 203	177.0 80.3	NA	NA	NA	NA
20[1] DN500	20.000 508.0	8.00 (s) 203	218.0 98.9	8.00 (s) 203	218.0 98.9	NA	NA	NA	NA
24[1] DN600	24.000 609.6	8.00 (s) 203	283.0 128.4	8.00 (s) 203	283.0 128.4	NA	NA	NA	NA
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05								

1 For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

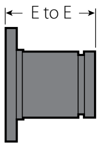
"+" = Contact Victaulic for details

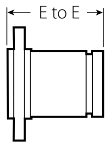
NOTE
- All fittings are ductile iron unless otherwise noted with an (s).

4.16 DIMENSIONS (CONTINUED)

Flange Adapter Nipple

No 46F
No 46R





Size		No. 46F ANSI Class 300 Flange Adapter Nipple Flat Face (s)		No. 46R ANSI Class 300 Flange Adapter Nipple Raised Face (s)	
Nominal inches DN	Actual Outside Diameter inches mm	E to E inches mm	Approx. Weight (Each) lb kg	E to E inches mm	Approx. Weight (Each) lb kg
¾ DN20	1.050 26.9	3.00 76	3.3 1.5	3.00 76	+
1 DN25	1.315 33.7	3.00 76	3.9 1.8	3.00 76	3.9 1.8
1 ¼ DN32	1.660 42.4	4.00 102	4.8 2.2	4.00 102	4.8 2.2
1 ½ DN40	1.900 48.3	4.00 102	6.9 3.1	4.00 102	6.9 3.1
2 DN50	2.375 60.3	4.00 102	8.1 3.7	4.00 102	8.1 3.7
2 ½	2.875 73.0	4.00 102	11.9 5.4	4.00 102	11.9 5.4
3 DN80	3.500 88.9	4.00 102	16.5 7.5	4.00 102	16.5 7.5
3 ½ DN90	4.000 101.6	4.00 102	20.1 9.1	4.00 102	20.1 9.1
4 DN100	4.500 114.3	6.00 152	27.4 12.4	6.00 152	27.4 12.4
5	5.563 141.3	6.00 152	35.3 16.0	6.00 152	35.3 16.0
6 DN150	6.625 168.3	6.00 152	47.5 21.5	6.00 152	47.5 21.5
8 DN200	8.625 219.1	6.00 152	68.0 30.8	6.00 152	68.0 30.8
10 DN250	10.750 273.0	8.00 203	100.8 45.7	8.00 203	100.8 45.7
12 DN300	12.750 323.9	8.00 203	148.0 67.1	8.00 203	148.0 67.1
14[1] DN350	14.000 355.6	8.00 203	180.0 81.8	NA	NA
16[1] DN400	16.000 406.4	8.00 203	237.0 107.5	NA	NA
18[1] DN450	18.000 457.2	8.00 203	297.0 134.7	NA	NA
20[1] DN500	20.000 508.0	8.00 203	+	NA	NA
22[1] DN550	22.000 558.8	8.00 203	+	NA	NA
24[1] DN600	24.000 609.6	8.00 203	+	NA	NA
14 – 60 DN350 – DN1500	For AGS fitting information, see publication 20.05				

1 For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

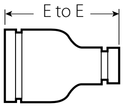
NA = Not Available

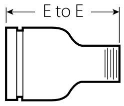
+ = Contact Victaulic for details

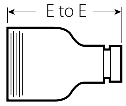
4.12 DIMENSIONS

Swaged Nipple

No. 53
No. 54
No. 55







Size		No. 53 Swage Nipple Groove x Groove (s)		No. 54 Swage Nipple Groove x Male Thread[1] (s)		No. 55 Swage Nipple Male Thread[1] x Groove (s)	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
2 x ¾ DN50 x DN20	2.375 x 1.050 60.3 x 26.9	6.50 165	2.0 0.9	NA	NA	NA	NA
1 DN25	1.315 33.7	6.50 165	2.0 0.9	6.50 165	2.0 0.9	6.50 165	2.0 0.9
1 ¼ DN32	1.660 42.4	6.50 165	2.0 0.9	6.50 165	2.0 0.9	6.50 165	2.0 0.9
1 ½ DN40	1.900 48.3	6.50 165	2.0 0.9	6.50 165	2.0 0.9	6.50 165	2.0 0.9
2 ½ x 1 DN25	2.875 x 1.315 73.0 33.7	7.00 178	3.0 1.4	7.00 178	3.0 1.4	7.00 178	3.0 1.4
1 ¼ DN32	1.660 42.4	7.00 178	3.0 1.4	7.00 178	3.0 1.4	7.00 178	3.0 1.4
1 ½ DN40	1.900 48.3	7.00 178	3.0 1.4	7.00 178	3.0 1.4	7.00 178	3.0 1.4
2 DN50	2.375 60.3	7.00 178	3.0 1.4	7.00 178	3.0 1.4	7.00 178	3.0 1.4
x 1 ½ DN65 DN40	3.000 x 1.900 76.1 48.3	NA	NA	8.00 203	4.0 1.8	NA	NA
2 DN50	2.375 60.3	8.00 203	4.0 1.8	NA	NA	NA	NA
3 x 1 DN80 DN25	3.500 x 1.315 88.9 33.7	8.00 203	4.5 2.0	8.00 203	4.5 2.0	8.00 203	4.5 2.0
1 ¼ DN32	1.660 42.4	8.00 203	4.5 2.0	8.00 203	4.5 2.0	8.00 203	4.5 2.0
1 ½ DN40	1.900 48.3	8.00 203	4.5 2.0	8.00 203	4.5 2.0	8.00 203	4.5 2.0
2 DN50	2.375 60.3	8.00 203	4.5 2.0	8.00 203	4.5 2.0	8.00 203	4.5 2.0
2 ½	2.875 73.0	8.00 203	4.5 2.0	8.00 203	4.5 2.0	8.00 203	4.5 2.0
DN65	3.000 76.1	8.00 203	4.5 2.0	8.00 203	4.5 2.0	NA	NA
3 ½ x 3 DN90 DN80	4.000 x 3.500 101.6 88.9	8.00 203	6.8 3.1	8.00 203	6.8 3.1	8.00 203	6.8 3.1
4 x 1 DN100 DN25	4.500 x 1.315 114.3 33.7	9.00 229	7.5 3.4	9.00 229	7.5 3.4	9.00 229	7.5 3.4
1 ¼ DN32	1.660 42.4	9.00 229	7.5 3.4	9.00 229	7.5 3.4	NA	NA
1 ½ DN40	1.900 48.3	9.00 229	7.5 3.4	9.00 229	7.5 3.4	9.00 229	7.5 3.4
2 DN50	2.375 60.3	9.00 229	7.5 3.4	9.00 229	7.5 3.4	9.00 229	7.5 3.4
2 ½	2.875 73.0	9.00 229	7.5 3.4	9.00 229	7.5 3.4	9.00 229	7.5 3.4
DN65	3.000 76.1	9.00 229	7.5 3.4	NA	NA	NA	NA
3 DN80	3.500 88.9	9.00 229	7.5 3.4	9.00 229	7.5 3.4	9.00 229	7.5 3.4
3 ½ DN90	4.000 101.6	9.00 229	7.5 3.4	9.00 229	7.5 3.4	9.00 229	7.5 3.4

[1] Available with British Standard Pipe Threads, specify BSP clearly on order.

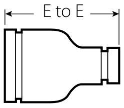
(s) = Carbon Steel

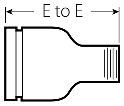
NA = Not Available

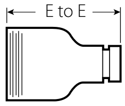
4.12 DIMENSIONS

Swaged Nipple

No. 53
No. 54
No. 55







Size						No. 53 Swage Nipple Groove x Groove (s)		No. 54 Swage Nipple Groove x Male Thread[1] (s)		No. 55 Swage Nipple Male Thread[1] x Groove (s)	
Nominal inches DN			**Actual Outside Diameter** inches mm			**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
5	x	2 DN50	5.563 141.3	x	2.375 60.3	11.00 279	11.5 5.2	11.00 279	11.5 5.2	11.00 279	11.5 5.2
		3 DN80			3.500 88.9	11.00 279	11.5 5.2	11.00 279	11.5 5.2	11.00 279	11.5 5.2
		4 DN100			4.500 114.3	11.00 279	11.5 5.2	11.00 279	11.5 5.2	11.00 279	11.5 5.2
6 DN150	x	1 DN25		x	1.315 33.7	12.00 305	17.0 7.7	12.00 305	17.0 7.7	12.00 305	17.0 7.7
		1 ¼ DN32			1.660 42.4	12.00 305	17.0 7.7	12.00 305	17.0 7.7	12.00 305	17.0 7.7
		1 ½ DN40			1.900 48.3	12.00 305	17.2 7.8	12.00 305	17.2 7.8	12.00 305	17.0 7.7
		2 DN50			2.375 60.3	12.00 305	17.4 7.9	12.00 305	17.4 7.9	12.00 305	17.4 7.9
		2 ½			2.875 73.0	12.00 305	17.4 7.9	12.00 305	17.4 7.9	12.00 305	17.4 7.9
		3 DN80			3.500 88.9	12.00 305	17.4 7.9	12.00 305	17.4 7.9	12.00 305	17.4 7.9
		3 ½ DN90			4.000 101.6	12.00 305	17.5 7.9	12.00 305	17.5 7.9	NA	NA
		4 DN100			4.500 114.3	12.00 305	17.5 7.9	12.00 305	17.5 7.9	12.00 305	17.5 7.9
		4 ½			5.000 127.0	12.00 305	17.5 7.9	12.00 305	17.5 7.9	NA	NA
		5			5.563 141.3	12.00 305	17.5 7.9	12.00 305	17.5 7.9	12.00 305	17.5 7.9
8 DN200	x	6 DN150	8.625 219.1	x	6.625 168.3	12.00 305	29.0 13.2	12.00 305	29.0 13.2	12.00 305	29.0 13.2

1 Available with British Standard Pipe Threads, specify BSP clearly on order.

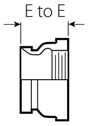
(s) = Carbon Steel

NA = Not Available

4.13 DIMENSIONS

Female Threaded Adapter

No. 80



Size		No. 80 Adapter Groove x Female Thread[1]	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	2.00 (s) 51	0.6 0.3
1 DN25	1.315 33.7	2.08 53	0.4 0.2
1 ¼ DN32	1.660 42.4	2.29 58	0.6 0.3
1 ½ DN40	1.900 48.3	2.29 58	1.0 0.5
2 DN50	2.375 60.3	2.50 64	1.5 0.7
2 ½	2.875 73.0	2.75 70	1.8 0.8
DN65	3.000 76.1	2.75 70	2.2 1.0
3 DN80	3.500 88.9	2.75 70	2.8 1.3
4 DN100	4.500 114.3	3.25 83	4.5 2.0

1 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(s) = Carbon Steel

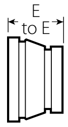
NOTE

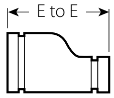
- All fittings are ductile iron unless otherwise noted with an (s).

4.15 DIMENSIONS

Concentric/Eccentric Reducer

No. 50
No. 51





Size						No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal inches DN			Actual Outside Diameter inches mm			E to E inches mm	Approx. Weight (Each) lb kg	E to E inches mm	Approx. Weight (Each) lb kg
1 DN25	x	¾ DN20	1.315 33.7	x	1.050 26.9	8.00 (s) 203	+	8.00 (s) 203	+
1¼ DN32	x	¾ DN20	1.660 42.4	x	1.050 26.9	8.00 (s) 203	1.3 0.6	8.00 (s) 203	1.3 0.6
		1 DN25			1.315 33.7	2.50 64	0.6 0.3	8.00 (s) 203	1.4 0.6
1½ DN40	x	¾ DN20	1.900 48.3	x	1.050 26.9	8.50 (s) 216	1.5 0.7	8.50 (s) 216	1.5 0.7
		1 DN25			1.315 33.7	2.50 64	0.8 0.4	8.50 (s) 216	1.7 0.8
		1¼ DN32			1.660 42.4	2.50 64	0.9 0.4	8.50 (s) 216	1.8 0.8
2 DN50	x	¾ DN20	2.375 60.3	x	1.050 26.9	2.50 64	0.8 0.4	9.00 (s) 229	2.2 1.0
		1 DN25			1.315 33.7	2.50 64	0.7 0.3	9.00 (s) 229	2.3 1.0
		1¼ DN32			1¼ DN32	2.50 64	0.8 0.4	9.00 (s) 229	2.5 1.1
		1½ DN40			1.900 48.3	2.50 64	1.2 0.5	3.50 89	1.1 0.5
2½	x	¾ DN20	2.875 73.0	x	1.050 26.9	9.50 (s) 241	+	9.50 (s) 241	+
		1 DN25			1.315 33.7	2.50 64	1.4 0.6	9.50 (s) 241	3.4 1.5
		1¼ DN32			1¼ DN32	2.50 64	1.4 0.6	3.50 89	1.3 0.6
		1½ DN40			1.900 48.3	2.50 64	1.4 0.6	9.50 (s) 241	3.8 1.7
		2 DN50			2.375 60.3	2.50 64	1.5 0.7	3.50 89	1.6 0.7
DN65	x	1 DN25	3.000 76.1	x	1.315 33.7	2.50 64	+	9.50 (s) 241	+
		1¼ DN32			1.660 42.4	2.50 64	+	9.50 (s) 241	+
		1½ DN40			1.900 48.3	2.50 64	+	9.50 (s) 241	+
		2 DN50			2.375 60.3	2.50 64	+	9.50 (s) 241	+
		2½			2.875 73.0	2.50 64	+	9.50 (s) 241	+

[1] For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

"+" = Contact Victaulic for details

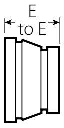
NOTES

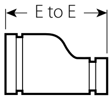
- All fittings are ductile iron unless otherwise noted with an (s).
- Available with make threaded small end No. 52
- Steel eccentric reducers available through 30"/DN750, contact Victaulic for dimensions.

4.15 DIMENSIONS (CONTINUED)

Concentric/Eccentric Reducer

No. 50
No. 51





Size						No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal inches DN			**Actual Outside Diameter** inches mm			**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
3 DN80	x	¾ DN20	3.500 88.9	x	1.050 26.9	9.50 (s) 241	+	9.50 (s) 241	+
		1 DN25			1.315 33.7	2.50 64	1.8 0.8	9.50 (s) 241	4.8 2.2
		1 ¼ DN32			1.660 42.4	2.50 64	1.4 0.6	9.50 (s) 241	5.0 2.3
		1 ½ DN40			1.900 48.3	2.50 64	2.0 0.9	9.50 (s) 241	5.1 2.3
		2 DN50			2.375 60.3	2.50 64	1.6 0.7	3.50 89	1.9 0.9
		2 ½			2.875 73.0	2.50 64	1.7 0.7	3.50 89	2.1 1.0
		DN65			3.000 76.1	2.50 64	2.1 1.0	9.50 (s) 241	5.4 2.4
3 ½ DN90	x	3 DN80	4.000 101.6	x	3.500 88.9	2.50 64	2.1 1.0	10.00 (s) 254	7.0 3.2
			4.250 108.0	x	2.875 73.0	3.50 89	+	NA	NA
					3.000 76.1	3.50 89	+	NA	NA
					3.500 88.9	3.50 89	+	NA	NA
4 DN100	x	1 DN25	4.500 114.3	x	1.315 33.7	3.00 76	3.0 1.4	10.00 (s) 254	6.5 2.9
		1 ¼ DN32			1.660 42.4	10.00 (s) 254	+	10.00 (s) 254	+
		1 ½ DN40			1.900 48.3	3.00 76	2.6 1.2	10.00 (s) 254	6.9 3.1
		2 DN50			2.375 60.3	3.00 76	3.4 1.5	4.00 102	2.9 1.3
		DN65			3.000 76.1	3.00 76	3.3 1.5	4.00 102	3.2 1.4
		2 ½			2.875 73.0	3.00 76	3.3 1.5	4.00 102	3.1 1.4
		3 DN80			3.500 88.9	3.00 76	3.2 1.5	4.00 102	3.4 1.5
		3 ½ DN90			4.000 101.6	3.00 76	3.0 1.4	10.00 (s) 254	8.1 3.7
			5.250 133.0	x	4.250 108.0	4.50 114	+	NA	NA

1 For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

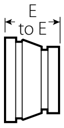
"+" = Contact Victaulic for details

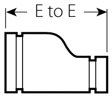
NOTES

- All fittings are ductile iron unless otherwise noted with an (s).
- Available with make threaded small end No. 52
- Steel eccentric reducers available through 30"/DN750, contact Victaulic for dimensions.

4.15 DIMENSIONS

Concentric/Eccentric Reducer
No. 50
No. 51





Size		No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
x 2 DN125 DN50	5.500 x 2.375 139.7 60.3	11.00 (s) 279		11.00 (s) 279	
DN65	3.000 76.1	4.50 114	4.1 1.9	11.00 (s) 279	10.7 4.9
3 DN80	3.500 88.9	4.50 114	5.7 2.6	11.00 (s) 279	+
4 DN100	4.500 114.3	4.50 114	5.1 2.3	5.00 127	+
5 x 2 DN50	5.563 x 2.375 141.3 60.3	11.00 (s) 279	10.1 4.6	11.00 (s) 279	10.1 4.6
2½	2.875 73.0	4.00 102	4.3 2.0	11.00 279	10.8 4.9
3 DN80	3.500 88.9	4.00 102	5.7 2.6	11.00 (s) 279	11.1 5.0
3½ DN90	4.000 101.6	11.00 (s) 279	+	11.00 (s) 279	+
4 DN100	4.500 114.3	3.50 89	4.3 2.0	5.00 127	5.5 2.5
	6.250 x 3.500 159.0 88.9	4.50 114	+	NA	NA
	4.250 108.0	4.00 102	+	NA	NA
	4.500 114.3	4.00 102	+	NA	NA
	5.250 133.0	4.00 102	+	NA	NA
	6.500 x 2.375 165.1 60.3	4.00 102	6.1 2.8	11.50 (s) 292	NA
	3.000 76.1	4.00 102	5.9 2.7	10.50 (s) 292	18.1 8.2
	3.500 88.9	4.00 102	6.2 2.8	5.50 140	6.1 2.8
	4.500 114.3	4.00 102	6.2 2.8	5.50 140	6.8 3.1
	5.500 139.7	4.00 102	5.6 2.5	5.50 140	8.0 3.6
	5.563 141.3	4.00 102	6.4 2.9	5.50 140	7.5 3.4
	6.250 159.0	4.00 102	6.6 3.0	NA	NA

[1] For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

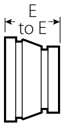
"+" = Contact Victaulic for details

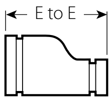
NOTES
- All fittings are ductile iron unless otherwise noted with an (s).
- Available with make threaded small end No. 52
- Steel eccentric reducers available through 30"/DN750, contact Victaulic for dimensions.

4.15 DIMENSIONS

Concentric/Eccentric Reducer

No. 50
No. 51





Size		No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
6 x 1 DN150 DN25	6.625 x 1.315 168.3 33.7	4.00 102	6.2 2.8	11.50 (s) 292	+
1 ½ DN40	1.900 48.3	11.50 (s) 292	+	11.50 (s) 292	+
2 DN50	2.375 60.3	4.00 102	6.6 3.0	11.50 (s) 292	14.2 6.4
2 ½	2.875 73.0	4.00 102	6.4 2.9	11.50 (s) 292	14.2 6.4
DN65	3.000 76.1	11.50 (s) 292	+	11.50 (s) 292	+
3 DN80	3.500 88.9	4.00 102	6.4 2.9	5.50 140	7.4 3.4
4 DN100	4.500 114.3	4.00 102	5.8 2.6	5.50 140	7.8 3.5
DN125	5.500 139.7	4.00 102	6.4 2.9	5.50 140	8.1 3.7
5	5.563 141.3	4.00 102	6.4 2.9	5.50 140	8.1 3.7
	6.500 165.1	4.00 102	7.2 3.3	11.50 (s) 292	+
	8.515 x 3.500 216.3 88.9	5.00 127	+	NA	NA
	4.500 114.3	5.00 127	+	NA	NA
	5.500 139.7	4.50 114	+	NA	NA
200A x 165A	216.3 x 6.500 165.1	5.00 127	9.5 4.3	NA	NA

[1] For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

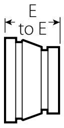
"+" = Contact Victaulic for details

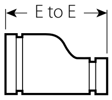
NOTES

- All fittings are ductile iron unless otherwise noted with an (s).
- Available with make threaded small end No. 52
- Steel eccentric reducers available through 30"/DN750, contact Victaulic for dimensions.

4.15 DIMENSIONS

Concentric/Eccentric Reducer
No. 50
No. 51





Size						No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal inches DN			**Actual Outside Diameter** inches mm			**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
8 DN200	x	2½	8.625 219.1	x	2.875 73.0	12.00 (s) 305	+	12.00 (s) 305	+
		76.1 mm			76.1	12.00 (s) 305	+	12.00 (s) 305	+
		3 DN80			3.500 88.9	5.00 127	9.3 4.2	12.00 (s) 305	22.0 10.0
					4.250 108.0	5.00 127	11.5 5.2	NA	NA
		4 DN100			4.500 114.3	5.00 127	10.4 4.7	6.00 152	10.5 4.8
		DN125			5.500 139.7	5.00 127	11.7 5.3	12.00 (s) 305	24.5 11.1
		5			5.563 141.3	5.00 127	11.6 5.3	12.00 (s) 305	23.8 10.8
					6.250 159.0	4.50 114	11.9 5.4	NA	NA
					6.500 165.1	4.50 114	12.6 5.7	6.00 152	12.8 5.8
		6 DN150			6.625 168.3	5.00 127	11.9 5.4	6.00 152	13.2 6.0
10 DN250	x	4 DN100	10.750 273.0	x	4.500 114.3	6.25 159	20.1 9.1	13.00 (s) 330	33.8 15.3
		DN125			5.500 139.7	13.00 (s) 330	+	13.00 (s) 330	35.7 16.2
		5			5.563 141.3	13.00 (s) 330	35.8 16.2	13.00 (s) 330	35.8 16.2
					6.500 165.1	6.00 152	+	13.00 (s) 330	+
		6 DN150			6.625 168.3	6.00 152	22.0 10.0	13.00 (s) 330	36.9 16.7
		8 DN200			8.625 219.1	6.00 152	23.0 10.4	7.00 178	37.0 16.8
250A	x	200A	267.4	x	216.3	6.00 152	23.0 10.4	NA	NA
12 DN300	x	4 DN100	12.750 323.9	x	4.500 114.3	14.00 (s) 356	48.0 21.8	14.00 (s) 356	48.0 21.8
					6.500 165.1	14.00 (s) 356	+	14.00 (s) 356	+
		6 DN150			6.625 168.3	7.00 178	25.0 11.3	14.00 (s) 356	50.2 22.8
		8 DN200			8.625 219.1	7.00 178	38.0 17.2	14.00 (s) 356	53.5 24.3
		10 DN200			10.750 273.0	7.00 178	38.0 17.2	14.00 (s) 356	56.5 25.6

[1] For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

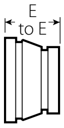
NA = Not Available

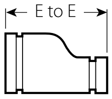
"+" = Contact Victaulic for details

NOTES
- All fittings are ductile iron unless otherwise noted with an (s).
- Available with make threaded small end No. 52
- Steel eccentric reducers available through 30"/DN750, contact Victaulic for dimensions.

4.15 DIMENSIONS

Concentric/Eccentric Reducer
No. 50
No. 51





Size						No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal inches DN			Actual Outside Diameter inches mm			E to E inches mm	Approx. Weight (Each) lb kg	E to E inches mm	Approx. Weight (Each) lb kg
300A	x	250A	318.5	x	216.3	7.00 178	38.0 17.2	NA	NA
14[1] DN350	x	6 DN150	14.000 355.6	x	6.625 168.3	13.00 330	63.1 28.6	13.00 330	77.2 35.0
		8 DN200			8.625 219.1	13.00 330	72.7 33.0	13.00 330	81.6 37.0
					10.528 267.4	13.00 330	80.5 36.5	13.00 330	88.2 40.0
		10 DN200			10.750 273.0	13.00 330	80.5 36.5	13.00 330	88.2 40.0
					12.539 318.5	13.00 330	81.6 37.0	13.00 330	90.4 41.0
		12 DN300			12.750 323.9	13.00 330	81.6 37.0	13.00 330	90.4 41.0
16[1] DN400	x	8 DN200	16.000 406.4	x	8.625 219.1	14.00 356	80.5 36.5	14.00 356	99.2 45.0
		250A			267.4	14.00 356	93.0 42.2	NA	NA
		10 DN200			10.750 273.0	14.00 356	93.0 42.2	14.00 356	99.2 45.0
					12.539 318.5	14.00 356	100.3 45.5	14.00 356	103.6 47.0
		12 DN300			12.750 323.9	14.00 356	100.3 45.5	14.00 356	103.6 47.0
		14 DN350			14.000 355.6	14.00 356	100.3 45.5	14.00 356	108.0 49.0
18[1] DN450	x	10 DN200	18.000 457.2	x	10.750 273.0	15.00 381	112.4 51.0	15.00 381	125.7 57.0
		12 DN300			12.750 323.9	15.00 381	122.4 55.5	15.00 381	134.5 61.0
		14 DN350			14.000 355.6	15.00 381	122.4 55.5	15.00 381	136.7 62.0
		16 DN400			16.000 406.4	15.00 381	126.8 57.5	15.00 381	143.3 65.0

1 For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

"+" = Contact Victaulic for details

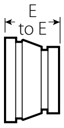
NOTES

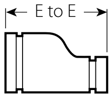
- All fittings are ductile iron unless otherwise noted with an (s).
- Available with make threaded small end No. 52
- Steel eccentric reducers available through 30"/DN750, contact Victaulic for dimensions.

4.15 DIMENSIONS

Concentric/Eccentric Reducer

No. 50
No. 51





Size						No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal inches DN			Actual Outside Diameter inches mm			E to E inches mm	Approx. Weight (Each) lb kg	E to E inches mm	Approx. Weight (Each) lb kg
20[1] DN500	x	10 DN200	20.000 508.0	x	10.750 273.0	20.00 508	160.0 72.6	20.00 508	172.0 78.0
		300A			318.5	20.00 508	162.3 73.6	NA	NA
		12 DN300			12.750 323.9	20.00 508	162.3 73.6	20.00 508	183.0 83.0
		14 DN350			14.000 355.6	20.00 508	177.5 80.5	20.00 508	191.8 87.0
		16 DN400			16.000 406.4	20.00 508	176.4 80.0	20.00 508	200.6 91.0
		18 DN450			18.000 457.2	20.00 508	205.0 93.0	20.00 508	209.4 95.0
24[1] DN600	x	10 DN200	24.000 609.6	x	10.750 273.0	20.00 508	222.7 101.0	20.00 508	222.7 101.0
		12 DN300			12.750 323.9	20.00 508	209.4 95.0	20.00 508	238.1 108.0
		14 DN350			14.000 355.6	20.00 508	213.8 97.0	20.00 508	246.9 112.0
		16 DN400			16.000 406.4	20.00 508	215.8 97.9	20.00 508	251.3 114.0
		18 DN450			18.000 457.2	20.00 508	229.3 104.0	20.00 508	244.7 111.0
		20 DN500			20.000 508.0	20.00 508	+	20.00 508	275.6 125.0
14 – 60 DN350 – DN1500			For AGS fitting information, see publication 20.05 AGS™						

1 For 14"/DN350 and larger roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales representative.

(s) = Carbon Steel

NA = Not Available

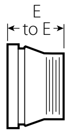
"+" = Contact Victaulic for details

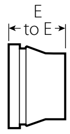
NOTES

- All fittings are ductile iron unless otherwise noted with an (s).
- Available with make threaded small end No. 52
- Steel eccentric reducers available through 30"/DN750, contact Victaulic for dimensions.

4.16 DIMENSIONS

Small Threaded Reducer
No. 52
No. 52F





Size						No. 52 Concentric Reducer Groove x Male Thread[1]		No. 52F Concentric Reducer Groove x Female BSPT Thread	
Nominal inches DN			Actual Outside Diameter inches mm			E to E inches mm	Approx. Weight (Each) lb kg	E to E inches mm	Approx. Weight (Each) lb kg
1 ¼ DN32	x	1 DN25	1.660 42.4	x	1.315 33.7	NA	NA	2.50 64	0.4 0.2
1 ½ DN40	x	1 DN25	1.900 48.3	x	1.315 33.7	2.50 64	0.8 0.4	NA	NA
		1 ¼ DN32			1.660 42.4	2.50 64	0.9 0.4	NA	NA
2 DN50	x	¾ DN20	2.375 60.3	x	1.050 26.9	2.56 65	0.8 0.4	NA	NA
		1 DN25			1.315 33.7	2.50 64	0.9 0.4	NA	NA
		1 ¼ DN32			1.660 42.4	2.50 64	0.9 0.4	NA	NA
		1 ½ DN40			1.900 48.3	2.50 64	1.0 0.5	NA	NA
2 ½	x	1 DN25	2.875 73.0	x	1.315 33.7	2.50 64	1.1 0.5	NA	NA
		1 ¼ DN32			1.660 42.4	2.50 64	1.6 0.7	NA	NA
		1 ½ DN40			1.900 48.3	2.50 64	1.6 0.7	NA	NA
		2 DN50			2.375 60.3	2.50 64	1.8 0.8	NA	NA
DN65	x	1 DN25	3.000 76.1	x	1.315 33.7	2.50 64	1.8 0.8	NA	NA
		1 ¼ DN32			1.660 42.4	2.50 64	1.8 0.8	NA	NA
		1 ½ DN40			1.900 48.3	2.50 64	1.8 0.8	2.50 64	1.8 0.8
		2 DN50			2.375 60.3	2.50 64	1.8 0.8	2.50 64	2.0 0.9

[1] Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(s) = Carbon Steel

NA = Not Available

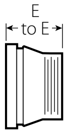
"+" = Contact Victaulic for details

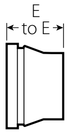
NOTE

- All fittings are ductile iron unless otherwise noted with an (s).

4.16 DIMENSIONS

Small Threaded Reducer
No. 52
No. 52F





Size				No. 52 Concentric Reducer Groove x Male Thread[1]		No. 52F Concentric Reducer Groove x Female BSPT Thread	
Nominal inches DN		Actual Outside Diameter inches mm		E to E inches mm	Approx. Weight (Each) lb kg	E to E inches mm	Approx. Weight (Each) lb kg
3 x DN80	¾ DN25	3.500 x 88.9	1.050 26.9	9.50 (s) 241	+	NA	NA
	1 DN25		1.315 33.7	2.50 64	1.8 0.8	NA	NA
	1 ¼ DN32		1.660 42.4	2.50 64	1.5 0.7	2.50 64	2.0 0.9
	1 ½ DN40		1.900 48.3	2.50 64	2.2 1.0	2.50 64	2.0 0.9
	2 DN50		2.375 60.3	2.50 64	2.0 0.9	2.50 64	2.0 0.9
	2 ½		2.875 73.0	2.50 64	2.4 1.1	NA	NA
	DN65		3.000 76.1	2.50 64	2.4 1.1	2.50 64	2.0 0.9
		4.250 x 108.0	1.660 42.4	NA	NA	3.00 76	2.9 1.3
			1.900 48.3	NA	NA	3.00 76	3.1 1.4
			2.375 60.3	3.00 76	1.3 0.6	3.00 76	3.1 1.4
			2.875 73.0	3.00 76	1.3 0.6	NA	NA
			3.000 76.1	3.00 76	1.3 0.6	NA	NA
			3.500 88.9	3.50 89	3.4 1.5	NA	NA
4 x DN100	1 DN25	4.500 x 114.3	1.315 33.7	3.00 76	3.0 1.4	NA	NA
	1 ¼ DN32		1.660 42.4	NA	NA	3.00 76	3.3 1.5
	1 ½ DN40		1.900 48.3	3.00 76	2.7 1.2	3.00 76	3.3 1.5
	2 DN50		2.375 60.3	3.00 76	3.5 1.6	3.00 76	3.5 1.6
	2 ½		2.875 73.0	3.00 76	3.5 1.6	NA	NA
	DN65		3.000 76.1	3.00 76	2.9 1.3	NA	NA
	3 DN80		3.500 88.9	3.00 76	3.5 1.6	NA	NA

[1] Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(s) = Carbon Steel

NA = Not Available

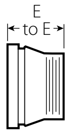
"+" = Contact Victaulic for details

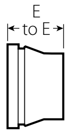
NOTE

- All fittings are ductile iron unless otherwise noted with an (s).

4.16 DIMENSIONS

Small Threaded Reducer
No. 52
No. 52F





Size		No. 52 Concentric Reducer Groove x Male Thread[1]		No. 52F Concentric Reducer Groove x Female BSPT Thread	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
	5.250 x 3.500 133.0 88.9	4.50 114	4.6 2.1	NA	NA
x DN125 DN65	5.500 x 3.000 139.7 76.1	4.50 114	4.4 2.0	NA	NA
3 DN80	3.500 88.9	4.50 114	4.4 2.0	NA	NA
5 x 2 DN50	5.563 x 2.375 141.3 60.3	11.00 (s) 279	3.5 1.6	NA	NA
3 DN80	3.500 88.9	11.00 (s) 279	3.6 1.6	NA	NA
4 DN100	4.500 114.3	11.00 (s) 279	11.9 5.4	NA	NA
	6.250 x 1.660 159.0 42.4	NA	NA	4.50 114	5.5 2.5
	1.900 48.3	NA	NA	4.50 114	5.5 2.5
	2.375 60.3	NA	NA	4.50 114	5.5 2.5
	3.000 76.1	4.50 114	5.1 2.3	NA	NA
	3.500 88.9	4.75 121	5.5 2.5	NA	NA
	6.500 x 1.660 165.1 42.4	NA	NA	4.00 102	6.4 2.9
	1.900 48.3	NA	NA	4.00 102	6.6 3.0
	2.375 60.3	4.00 102	5.5 2.5	4.00 102	6.6 3.0
	3.000 76.1	4.00 102	5.9 2.7	NA	NA
	3.500 88.9	4.00 102	6.6 3.0	NA	NA

1 Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(s) = Carbon Steel

NA = Not Available

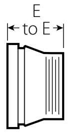
"+" = Contact Victaulic for details

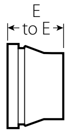
NOTE

- All fittings are ductile iron unless otherwise noted with an (s).

4.16 DIMENSIONS

Small Threaded Reducer
No. 52
No. 52F





Size		No. 52 Concentric Reducer Groove x Male Thread[1]		No. 52F Concentric Reducer Groove x Female BSPT Thread	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg	**E to E** inches mm	**Approx. Weight (Each)** lb kg
6 x 1 DN150 x DN25	6.625 x 1.315 168.3 x 33.7	4.00 102	5.5 2.5	NA	NA
2 DN50	2.375 60.3	4.00 102	6.7 3.0	NA	NA
2½	2.875 73.0	4.00 102	5.8 2.6	NA	NA
3 DN80	3.500 88.9	4.00 102	8.0 3.6	NA	NA
4 DN100	4.500 114.3	11.50 (s) 292	15.9 7.2	NA	NA
5	5.563 141.3	11.50 (s) 292	20.0 9.1	NA	NA
8 x 4 DN200 x DN100	4.500 114.3	12.00 (s) 305	22.9 10.4	NA	NA
6 DN150	6.625 168.3	12.00 (s) 305	25.0 11.3	NA	NA

[1] Available with British Standard Pipe Threads, specify "BSP" clearly on order.

(s) = Carbon Steel

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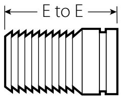
"+" = Contact Victaulic for details

NOTE
- All fittings are ductile iron unless otherwise noted with an (s).

4.16 DIMENSIONS (CONTINUED)

Hose Nipple
No. 48



Size		No. 48 Hose Nipple (s)	
Nominal inches DN	**Actual Outside Diameter** inches mm	**E to E** inches mm	**Approx. Weight (Each)** lb kg
¾ DN20	1.050 26.9	3.13 79	0.3 0.1
1 DN25	1.315 33.7	3.38 86	0.4 0.2
1¼ DN32	1.660 42.4	3.88 98	0.6 0.3
1½ DN40	1.900 48.3	3.88 98	0.8 0.4
2 DN50	2.375 60.3	4.50 114	1.0 0.4
2½	2.875 73.0	5.38 137	2.0 0.9
3 DN80	3.500 88.9	5.75 146	3.1 1.4
4 DN100	4.500 114.3	7.00 178	4.9 2.2
5	5.563 141.3	8.75 222	8.0 3.6
6 DN150	6.625 168.3	10.13 257	14.3 6.5
8 DN200	8.625 219.1	11.88 302	24.7 11.2
10 DN250	10.750 273.0	12.50 318	41.0 18.6
12 DN300	12.750 323.9	14.50 368	62.0 28.1

(s) = Carbon Steel

5.0 PERFORMANCE

Flow Data

(Frictional Resistance)

The chart expresses the frictional resistance of various Victaulic fittings as equivalent feet of straight pipe. Fittings not listed can be estimated from the data given, for example, a 22½° elbow is approximately one-half the resistance of a 45° elbow. Values of mid-sizes can be interpolated.

Size		90° Elbows		45° Elbows		Tees	
Nominal inches DN	**Actual Outside Diameter** inches mm	**No. 10 Std. Radius** feet meters	**No. 100 1 ½ D Long Radius** inches mm	**No. 11 Std. Radius** feet meters	**No. 110 1 ½ D Long Radius** inches mm	**Branch** feet meters	**Run** feet meters
¾ DN20	1.050 26.9	1.4 0.4	–	0.7 0.2	–	3.3 1.0	1.4 0.4
1 DN25	1.315 33.7	1.7 0.5	–	0.8 0.2	–	4.2 1.3	1.7 0.5
1 ¼ DN32	1.660 42.4	3.8 1.1	–	4.5 1.4	–	6.1 1.9	1.5 0.5
1 ½ DN40	1.900 48.3	5.5 1.7	–	3.7 1.1	–	6.1 1.9	1.2 0.4
2 DN50	2.375 60.3	3.6 1.1	2.5 0.8	1.8 0.5	1.1 0.3	8.5 2.6	3.6 1.1
DN65	3.000 76.1	4.3 1.3	–	2.3 0.7	–	10.8 3.3	4.3 1.3
3 DN80	3.500 88.9	5.0 1.5	3.8 1.2	2.6 0.8	1.6 0.5	13.0 4.0	5.0 1.5
	4.250 108.0	6.4 2.0	–	3.2 1.0	–	15.3 4.7	6.4 2.0
4 DN100	4.500 114.3	6.8 2.1	5.0 1.5	3.4 1.0	2.1 0.6	16.0 4.9	6.8 2.1
	5.250 133.0	8.1 2.5	–	4.1 1.3	–	20.0 6.1	8.1 2.5
DN125	5.500 139.7	8.5 2.6	–	4.2 1.3	–	21.0 6.4	8.5 2.6
5	5.563 141.3	8.5 2.6	–	4.2 1.3	–	21.0 6.4	8.5 2.6
	6.250 159.0	9.4 2.9	–	4.9 1.5	–	25.0 7.6	9.6 2.9
	6.500 165.1	9.6 2.9	–	5.0 1.5	–	25.0 7.6	10.0 3.0
6 DN150	6.625 168.3	10.0 3.0	7.5 2.3	5.0 1.5	3.0 0.9	25.0 7.6	10.0 3.0
8 DN200	8.625 219.1	13.1 4.0	9.8 3.0	6.5 2.0	4.0 1.2	33.1 10.1	13.1 4.0
10 DN250	10.750 273.0	17.0 5.2	12.0 3.7	8.3 2.5	5.0 1.5	41.0 12.5	17.0 5.2
12 DN300	12.750 323.9	20.0 6.1	14.5 4.4	10.0 3.0	6.0 1.8	50.0 15.2	20.0 6.1
14 DN350	14.000 355.6	24.5[1] 7.5	15.8 4.8	18.5[1] 5.6	11.0 3.4	70.0 21.3	23.0 7.0
16 DN400	16.000 406.4	28.0[1] 8.5	18.0 5.5	21.0[1] 6.4	13.0 4.0	80.0 24.4	27.0 8.2
18 DN450	18.000 457.2	31.0[1] 9.4	20.0 6.1	23.5[1] 7.2	14.0 4.3	90.0 27.4	30.0 9.1
20 DN500	20.000 508.0	34.0[1] 10.4	22.5 6.9	25.5[1] 7.8	16.0 4.9	100.0 30.5	33.0 10.1
24 DN600	24.000 609.6	42.0[1] 12.8	27.0 8.2	29.5[1] 9.0	19.0 5.8	120.0 36.6	40.0 12.2

[1] Fitting flow data for 14-24/DN350-DN600 size No. 10 and No. 11 Elbows is based on fittings for Style 07 and Style 77 couplings. For flow data on AGS fittings (No. W10 and No. W11 Elbows), refer to publication 20.05.

6.0 NOTIFICATIONS

⚠ WARNING

- **Read and understand all instructions before attempting to install any Victaulic products.**
- **Always verify that the piping system has been completely depressurized and drained immediately prior to installation, removal, adjustment, or maintenance of any Victaulic products.**
- **Confirm that any equipment, branch lines, or sections of piping that may have been isolated for/during testing or due to valve closures/positioning are identified, depressurized, and drained immediately prior to installation, removal, adjustment, or maitenance of any Victaulic products.**
- **The installer shall understand the use of this product and why it was specified for the particular application.**
- **The installer shall understand common industry safety standards and potential consequences of improper product installation.**
- **Wear safety glasses, hardhat, and foot protection.**

Failure to follow these instructions could result in death or serious personal injury and property damage.

7.0 REFERENCE MATERIALS

Galvanized
Publication 07.01 for Original Groove Fittings
Publication 20.05 for AGS Fittings

Extra Heavy EndSeal "ES"
Publication 07.03

Fabricated Steel Fittings
Publication 07.04

Shouldered Ends
Publication 07.06

xL fittings for abrasive services
Publication 07.07

Victaulic Base Support Elbows
Publication 07.13

Plain End
Publication 14.04

Stainless Steel
Publication 17.16

AGS - Advanced Groove System
from 14 – 60"/DN350 – DN1500
Publication 20.05

Aluminum
Publication 21.03

Copper
Publication 22.04

Ductile Iron for AWWA size pipe
Publication 23.05

FireLock™ Fittings

1.0 PRODUCT DESCRIPTION

Available Sizes

- 1 ¼ – 12"/DN32 – DN300

Maximum Working Pressure

- Pressure ratings for Victaulic FireLock™ Fittings conform to the ratings of Victaulic FireLock Installation-Ready™ Style 009N couplings (refer to publication 10.64 for more information).

Application

- FireLock™ fittings are designed for use exclusively with Victaulic couplings that have been Listed or Approved for Fire Protection Services. Use of other couplings or flange adapters may result in bolt pad interference.
- Connects pipe, provides change in direction and adapts sizes or components

Pipe Materials

- Carbon steel

2.0 CERTIFICATION/LISTINGS

c UL us LISTED · FM APPROVED · LPCB · VdS · CE · UKCA · CCC

CE: EN 10311 CPR (EU) No. 305/2011

UKCA: BS EN 10311 CPR (UK) 2019 No. 465

3.0 SPECIFICATIONS – MATERIAL

Fitting: Ductile iron conforming to ASTM A536, Grade 65-45-12.

Fitting Coating: (specify choice)

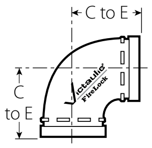
☐ Orange coating.

☐ Red coating (standard for EMEA-I and Asia Pacific).

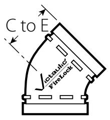
☐ Optional: Hot dipped galvanized.

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

4.0 DIMENSIONS



No. 001



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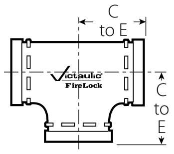

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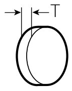


No. 006

		No. 001 90° Elbow		No. 003 45° Elbow		No. 002 Straight Tee		No. 006 Cap	
Nominal Size inches DN	**Actual Outside Diameter** inches mm	**C to E** inches mm	**Approximate Weight Each** lb kg	**C to E** inches mm	**Approximate Weight Each** lb kg	**C to E** inches mm	**Approximate Weight Each** lb kg	**T** inches mm	**Approximate Weight Each** lb kg
1 ¼ DN32	1.660 42.4	2.75 70	1.0 0.5	1.75 45	0.7 0.3	2.75 70	1.4 0.6	0.82 21	0.3 0.1
1 ½ DN40	1.900 48.3	2.75 70	1.2 0.5	1.75 45	0.8 0.4	2.75 70	1.8 0.8	0.82 21	0.4 0.2
2 DN50	2.375 60.3	2.75 70	1.6 0.7	2.00 51	1.4 0.6	2.75 70	2.4 1.1	0.88 22	0.6 0.3
2 ½	2.875 73.0	3.00 76	2.1 1.0	2.25 57	2.2 1.0	3.00 76	3.4 1.5	0.88 22	1.0 0.5
DN65	3.000 76.1	3.00 76	2.5 1.1	2.25 57	2.4 1.1	3.00 76	3.8 1.7	–	–
3 DN80	3.500 88.9	3.38 86	3.4 1.5	2.50 64	3.1 1.4	3.38 86	5.1 2.3	0.88 22	1.2 0.5
	4.250 108.0	4.00 102	5.7 2.6	3.00 76	5.1 2.3	4.00 102	7.5 3.4	–	–
4 DN100	4.500 114.3	4.00 102	5.9 2.7	3.00 76	4.9 2.2	4.00 102	6.8 3.1	1.00 25	2.4 1.1
DN125	5.500 139.7	4.88 124	12.4 5.6	3.25 83	8.2 3.7	4.88 124	15.4 7.0	–	–
5	5.563 141.3	4.88 124	7.8 3.5	3.25 83	8.3 3.8	4.88 124	15.3 6.9	1.00 25	4.1 1.9
	6.250 159.0	5.50 140	12.6 5.7	3.50 89	9.2 4.2	5.50 140	17.9 8.1	–	–
	6.500 165.1	5.43 138	13.0 5.9	3.50 89	9.4 4.2	5.50 140	19.7 8.9	–	–
6 DN150	6.625 168.3	5.50 140	13.7 6.2	3.50 89	10.4 4.7	5.50 140	20.2 9.2	1.00 25	5.9 2.7
	8.515 216.3	6.81 173	23.1 10.5	–	–	6.94 176	33.6 15.0	–	–
8 DN200	8.625 219.1	6.81 173	25.4 11.5	4.25 108	18.9 8.6	6.94 176	36.9 16.8	1.13 29	12.7 5.8
10 DN250	10.750 273.0	8.25 210	43.2 19.6	4.00 102	25.0 11.3	8.25 210	63.6 28.9	1.06 27	14.2 6.4
12 DN300	12.750 323.9	9.38 238	66.7 30.3	4.50 114	36.1 16.4	9.38 238	80.7 36.6	1.06 27	22.6 10.3

5.0 PERFORMANCE

Flow Data

Size		Flow Data Frictional Resistance			
Nominal inches DN	Actual Outside Diameter inches mm	No. 001 90° Elbow feet meters	No. 003 45° Elbow feet meters	No. 002 Straight Tee Branch feet meters	No. 002 Straight Tee Run feet meters
1¼ DN32	1.660 42.4	2.00 0.6	2.13 0.6	7.50 2.3	0.50 0.2
1½ DN40	1.900 48.3	2.63 0.8	2.75 0.8	6.63 2.0	1.00 0.3
2 DN50	2.375 60.3	3.50 1.1	1.88 0.6	8.50 2.6	3.50 1.1
2½	2.875 73.0	4.38 1.3	2.25 0.7	10.88 3.3	4.38 1.3
DN65	3.000 76.1	4.50 1.4	2.38 0.7	11.00 3.4	4.50 1.4
3 DN80	3.500 88.9	5.00 1.5	2.63 0.8	13.00 4.0	5.00 1.5
	4.250 108.0	6.50 2.0	3.25 1.0	15.38 4.7	6.50 2.0
4 DN100	4.500 114.3	6.88 2.1	3.50 1.1	16.00 4.9	6.88 2.1
DN125	5.500 139.7	8.38 2.6	4.13 1.3	20.63 6.3	8.38 2.6
5	5.563 141.3	8.50 2.6	4.25 1.3	21.00 6.4	8.50 2.6
	6.250 159.0	9.50 2.9	5.00 1.5	25.00 7.6	9.63 2.9
	6.500 165.1	9.88 3.0	5.00 1.5	24.50 7.5	9.88 3.0
6 DN150	6.625 168.3	10.00 3.0	5.00 1.5	25.00 7.6	10.00 3.0
216 DN200	8.515 216.3	13.00 4.0	-	33.00 10.1	13.00 4.0
8 DN200	8.625 219.1	13.00 4.0	6.50 2.0	33.00 12.5	13.00 5.2
10 DN250	10.750 273.0	17.00 5.2	8.30 2.50	41.00 12.5	17.00 5.2
12 DN300	12.750 323.9	20.00 6.1	10.00 3.0	50.00 15.2	20.00 6.1

[1] The flow data listed is based upon the pressure drop of Schedule 40 pipe.

6.0 NOTIFICATIONS

General Notes

NOTE: When assembling FireLock EZ™ couplings onto end caps, take additional care to make certain the end cap is fully seated against the gasket end stop. For FireLock EZ™ Style 009N/009H couplings, use FireLock™ No. 006 end caps containing the “EZ” marking on the inside face or No. 60 end caps containing the “QV EZ” marking on the inside face. Non-Victaulic end cap products shall not be used with Style 009/009V/009H/009N couplings.

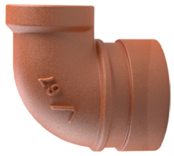
7.0 REFERENCE MATERIALS

10.64: Victaulic® FireLock™ Rigid Coupling Style 009N

10.02: Victaulic® FireLock™ Rigid Coupling Style 005H with Vic-Plus™ Gasket System

29.01: Victaulic® Terms and Conditions of Sale

Vic®-End II End of Run Fitting
No. 67



1.0 PRODUCT DESCRIPTION

Available Sizes

- 1 ¼ – 3"/DN32 – DN80 with ½/DN15, ¾"/DN20 or 1"/DN25 female threaded NPT or BSPT outlet.

Pipe Material

- Carbon Steel, Schedule 10, Schedule 40. For use with alternative materials and wall thicknesses please contact Victaulic.

Maximum Working Pressure

- Up to 365 psi/2500 kPa.

Function

- End of branchline elbow fitting for sprinkler connection.

2.0 CERTIFICATION/LISTINGS

FM c UL us LISTED

3.0 SPECIFICATIONS – MATERIAL

Housing:

Ductile iron conforming to ASTM A-536, grade 65-45-12, painted Orange Enamel. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

☐ Optional: Hot dipped galvanized.

Outlet: NPT

☐ Optional: BSPT

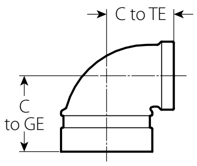
ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

System No.		Location	
Submitted By		Date	

Spec Section		Paragraph	
Approved		Date	

4.0 DIMENSIONS

No.67



Nominal Size inches DN	C to GE inches mm	C to TE inches mm	Approximate Weight (Each) lb kg
1 ¼ x ½ DN32 DN15	1.875 48	1.38 35	0.6 0.3
¾ DN20	1.875 48	1.38 35	0.5 0.2
1 DN25	2 51	1.75 44	0.6 0.3
1 ½ x ½ DN40 DN15	1.875 48	1.5 38	0.7 0.3
¾ DN20	1.875 48	1.5 38	0.7 0.3
1 DN25	2 51	1.625 41	0.7 0.3
2 x ½ DN50 DN15	1.875 48	1.75 44	0.7 0.3
¾ DN20	1.875 48	1.75 44	0.7 0.3
1 DN25	2 51	1.75 44	0.9 0.4
2 ½ x ½ DN65 DN15	1.875 48	2 51	1.3 0.6
¾ DN20	1.875 48	2 51	1.2 0.6
1 DN25	2 51	2 51	1.3 0.6
3 x ¾ DN80 DN20	2 51	2.375 60	2.0 0.9
1 DN25	2 51	2.375 60	1.9 0.9

5.0 PERFORMANCE

Please see applicable coupling publication for performance, or contact Victaulic for more information.

6.0 NOTIFICATIONS

⚠ WARNING	
	• This product must be installed by an experienced, trained installer, in accordance with the instructions provided with each valve. These instructions contain important information. Failure to follow these instructions may result in serious personal injury, property damage, or valve leakage. If you need additional copies of this product literature or the valve installation instructions, or if you have any questions about the safe installation and use of this device, contact Victaulic Company, P.O. Box 31, Easton, PA 18044-0031 U SA, Telephone: 001-610-559-3300.

7.0 REFERENCE MATERIALS

10.64: FireLock EZ™ Style 009N Rigid Coupling

60 Cohoes Ave. Green Island, NY 12183 • www.gemlockgrooved.com • Ph: (518) 270-2159 • Fax: (518) 270-8384

GROOVED FITTINGS - SHORT PATTERN

STYLES F105, F106, F107, F135 & F155

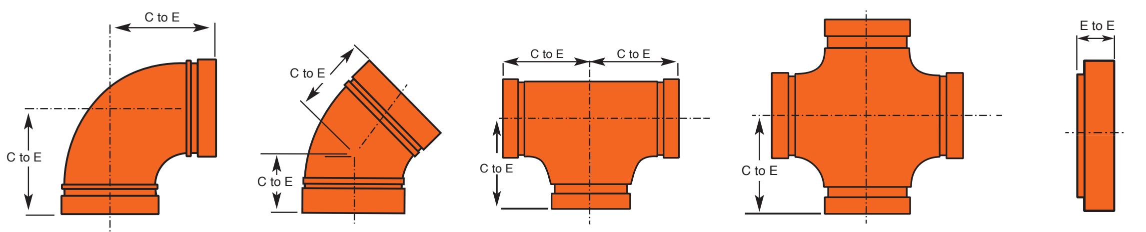
UL Listed
Under File No. EX15591

- Sized to improve flow
- Designed to Fire Protection Industry Standards for short pattern fittings
- Lighter and more cost effective than standard fittings
- Rated for 300 psi
- Made of durable, high-strength ductile iron conforming to ASTM A536; every lot is metallurgically tested for compliance
- Available with hot dipped galvanized coating

FLOW DATA
Frictional Resistance (Expressed as equivalent Straight Pipe in Ft.)

Nominal Size (In)	90° Elbow		45° Elbow		Tee			
					Branch		Run	
	STD	F105	STD	F106	STD	F107	STD	F107
1	1.7	1.4	0.9	0.9	4.4	4.0	1.7	1.4
1-1/4	2.3	1.8	1.2	1.0	5.8	4.2	2.3	1.8
1-1/2	2.7	2.5	1.3	1.3	6.7	5.5	2.7	2.5
2	3.4	3.2	1.7	1.6	8.6	8.2	3.4	2.5
2-1/2	4.1	3.9	2.1	2.0	10.3	10.1	4.1	3.9
3	5.1	4.8	2.6	2.4	12.8	12.5	5.1	4.8
4	6.7	6.5	3.4	3.2	16.8	16.0	6.7	6.5

Flow data is based upon the pressure drop of Sch. 40 pipe



Style F105 Style F106 Style F107 Style F135 Style F155

Pipe		90° Elbow No. F105		45° Elbow No. F106		Equal Tee No. F107		Cross No. F135		End Cap No. F155	
Nominal Size (In.)	Actual Size (In.)	C to E (In.)	Approx. Wgt. Ea. (Lb.)	C to E (In.)	Approx. Wgt. Ea. (Lb.)	C to E (In.)	Approx. Wgt. Ea. (Lb.)	C to E (In.)	Approx. Wgt. Ea. (Lb.)	E to E (In.)	Approx. Wgt. Ea. (Lb.)
1	1.315	2.24	0.80	1.50	.70	2.24	1.10	—	—	0.96	.33
1-1/4	1.66	2.36	0.96	1.73	0.88	2.36	1.18	—	—	0.96	0.40
1-1/2	1.9	2.362	1.01	1.73	.78	2.362	1.34	2.75	2.5	0.96	0.44
2	2.375	2.755	1.24	2.00	1.20	2.755	1.98	2.75	2.49	0.96	0.61
2-1/2	2.875	2.992	2.03	2.24	1.63	2.992	2.82	2.99	3.19	0.96	0.85
3	3.5	3.368	2.53	2.52	2.38	3.386	3.90	3.38	5.09	0.99	1.01
4	4.5	3.996	3.74	3.00	3.84	3.996	5.72	3.99	7.22	0.99	1.42
5	5.563	4.803	7.20	3.28	5.74	4.803	9.52	4.80	7.23	0.99	2.80
6	6.625	5.61	9.06	3.51	8.11	5.5	14.13	5.5	15.97	0.99	4.40
8	8.625	6.889	20.52	4.25	14.27	6.889	27.07	6.88	28.66	1.181	9.30

PROJECT	APPROVAL STAMP
PROJECT:	☐ APPROVED
ADDRESS:	☐ APPROVED AS NOTED
ENGINEER:	☐ NOT APPROVED
SUBMITTAL DATA:	REMARKS:
NOTES 1:	
NOTES 2:	

SECTION 2

Hangers & Attachments

TOLCO Fig. 29 - double offset hanger & restrainer for CPVC plastic pipe & IPS steel pipe

Size Range: Available in $^3/_4$" (20mm) and 1" (25mm) pipe sizes

Material: Pre-Galvanized Steel

Function: Intended to perform as a hanger and restrainer for CPVC, plastic fire sprinkler pipe. Provides double offset $1^1/_2$" (20mm) x $1^1/_2$" (20mm) from mounting surface. This design will ease installation by eliminating the need for wood block extension and allow retro-fit attachment of hanger to sprinkler pipe.

Features:

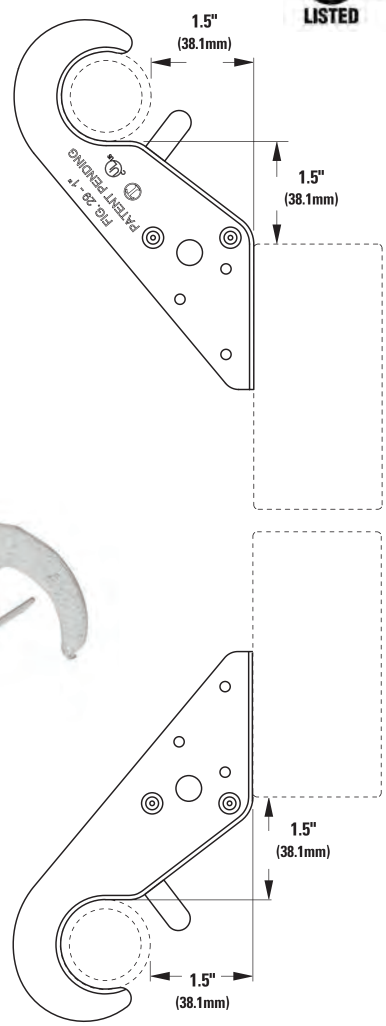
- Thumb tab provides protection to restrain pipe in rough job site conditions. Tab is not required to be bent for listed installation.
- Offset edge eliminates abrasion.
- Attaches easily to wood structure with two special #10 x 1" hex head self-threading screws furnished with product.
- Can be used as a single offset hanger by aligning "dimples" with top of mounting surface and utilizing two fasteners in two of the three holes provided.

Approvals: Underwriters Laboratories Listed in the USA **(UL)** and Canada **(cUL)** as a hanger and restrainer to support fire sprinkler systems. Meets and exceeds requirements of NFPA 13, 13R and 13D.

Finish: Pre-Galvanized

Order By: Figure number and pipe size.

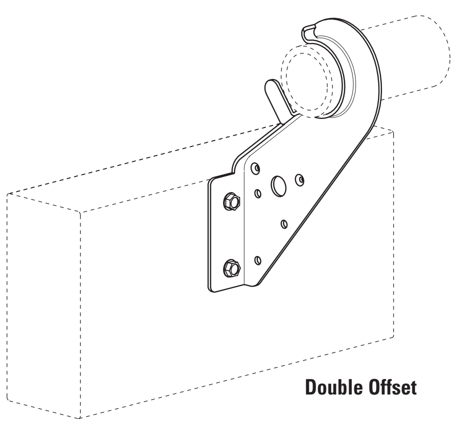
Patent # US2008/0129040A1



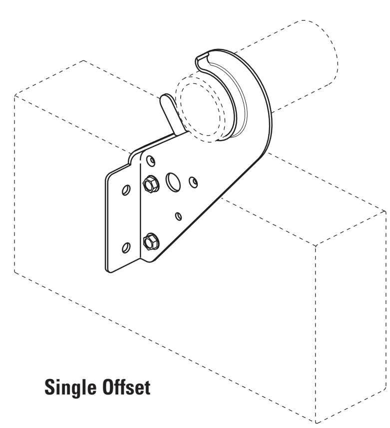
Part No.	CPVC Pipe size in. (mm)	Max Hanger Spacing Ft. (m)	Approx. Wt./100 lbs. (kg)
29-$^3/_4$	$^3/_4$" (20)	5'-6" (1.67)	18 (8.1)
29-1	1" (25)	6'-0" (1.83)	19 (8.6)

Reduced Spacing For IPS Pipe

Part No.	IPS Pipe Size in. (mm)	Max. Hanger Spacing Ft. (m)
29-$^3/_4$	$^3/_4$" (20)	1'-9" (1.67)
29-1	1" (25)	1'-10" (1.83)



Double Offset



Single Offset

Install using a rechargeable electric drill fitted with a $^5/_{16}$" (7.9mm) socket attachment with the special hex head self-tapping screws provided. Install screws until they bottom out. Pipe can be "snapped" into hanger before or after installation of the screws to the mounting surface. "Thumb tab" may be bent up to provide additional protection to the pipe, but is not required for performance of the hanger / restrainer function.

All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified. Updated 5-18-21

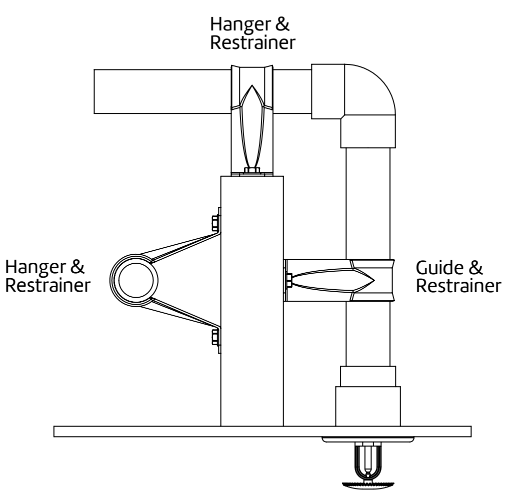
Two Hole Standoff Hanger and Restrainer
Fig. 188R (Formerly Afcon Fig. 514)

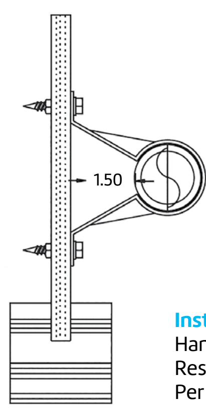
Size Range: ³⁄₄" through 2"
Material: Carbon Steel
Finish: Pre-Galvanized per ASTM A653
Service:
- Hanger and surge restraint for horizontal CPVC, steel, and copper piping when installed on the top, bottom, and side of the supporting structure.
- Guide for vertical CPVC, steel, and copper piping when installed on the side of the supporting structure.
- Horizontal and vertical seismic restraint per NFPA 13-2016 requirements.
- May be installed with concrete, steel structural members, and other structural members with fasteners which comply with the requirements of NFPA 13.

Approvals: cULus Listed
Patents: No. 6,648,278
Installation:
- Snap hanger over pipe. If needed, squeeze strap back around pipe.
- CPVC pipe must be allowed to slide freely through the Fig. 188R.
- Secure hanger to mounting surface with screws provided or with listed fasteners.

Features:
- Beveled edge design helps protect the CPVC pipe from any rough surface and eliminates pipe abrasion.
- Easily attaches to wood structure with #10 x 1" hex washer head self-threading screw supplied with product. No pre-drilling required.
- Bottom of pipe is offset 1½" from the structure. Eliminates wooden spacer blocks.

Ordering: Specify CPVC pipe size, figure number and description.



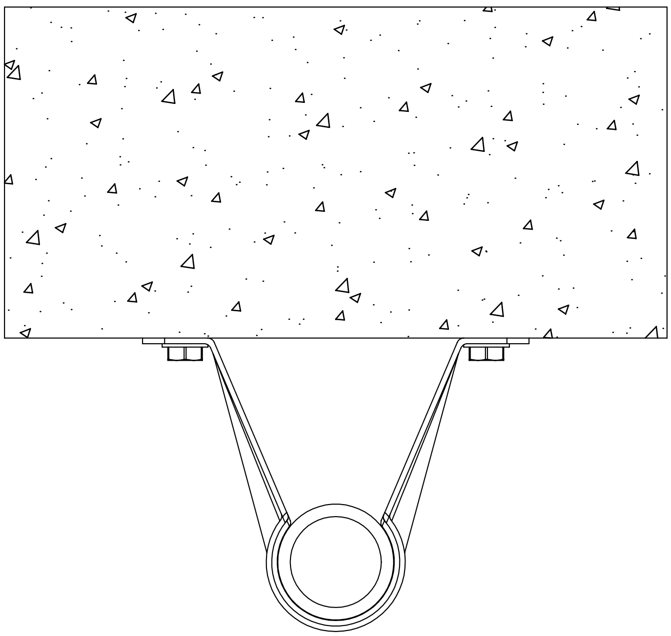


Installation – Backing Nut
Hanger = 1 – At top fastener
Restraint = 2 – On each fastener
Per NFPA-13D and NFPA-13R

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ Approved
Address:	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	Remarks:
Submittal Date:	
Notes 1:	
Notes 2:	

ASC Engineered Solutions

Two Hole Standoff Hanger and Restrainer (cont.)
Fig. 188R (Formerly Afcon Fig. 514)



Hanger and Restrainer

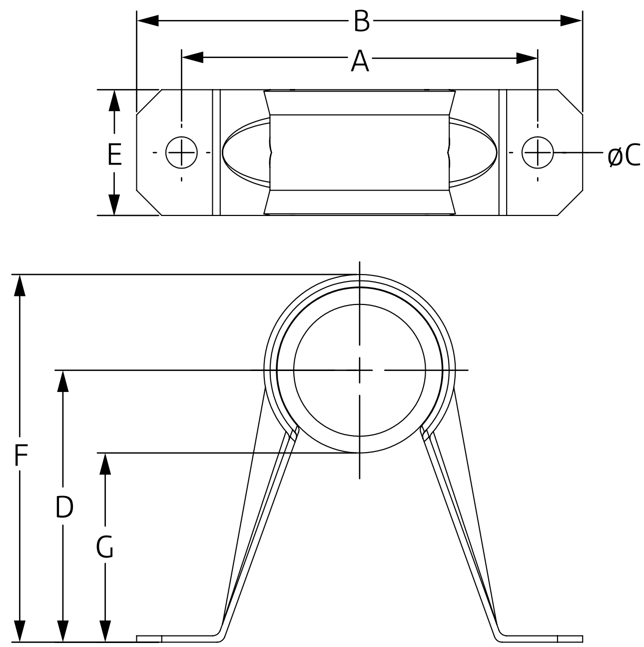


Fig. 188R: Dimensions (in) • **Weight** (lbs)

CPVC Pipe Size	A	B	øC	D	E	F	G	Max. Hanger Spacing (ft)	Approx. Weight/100 (lbs)
3/4	2 3/4	3 1/2	1/4	2	1	2 5/8	1 1/2	5 1/2	11
1	2 13/16	3 1/2	1/4	2 3/16	1	2 15/16	1 1/2	6	12
1 1/4	2 13/16	3 1/2	1/4	2 5/16	1	3 1/4	1 1/2	6 1/2	13
1 1/2	3 5/8	4 1/4	1/4	2 7/16	1	3 1/2	1 1/2	7	14
2	3 11/16	4 3/8	1/4	2 11/16	1	4	1 1/2	8	16

Fig. 188R: Listed Fasteners

Pipe	Wood and Composite Beams	Steel (18ga. Minimum)
CPVC	Screw Supplied or #10 x 1" TEK Screw	#14 x 1" TEK Screw or 1/4" x 1" TEK Screw
Steel & Copper	#14 x 1" TEK Screw or 1/4" x 1 1/2" Lag Screw	#14 x 1" TEK Screw or 1/4" x 1" TEK Screw

ANVIL
An ASC Engineered Solution

ASC Engineered Solutions

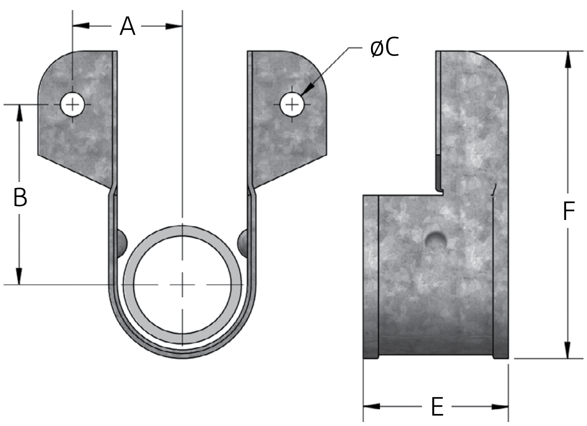
Two Hole 90° Side Mount Strap
Fig. 187 (Formerly Afcon Fig. 511)

Size Range: 3/4" through 2"
Material: Carbon Steel
Finish: Pre-Galvanized per ASTM A653
Service: Hanger for CPVC pipe in the horizontal position on the bottom of structural wood beams and Steel 20 Ga. (min.) (Fig. A). Can be used as a restrainer, only in Steel 20 Ga. (min) (Fig. B). During installation, adjust hanger mounting flanges such that pipe contacts both mounting surface and hanger, minimizing vertical pipe movement.
Approvals: UL and ULC Listed.
Installation:
- Snap hanger over pipe.
- Secure hanger to mounting surface with screws provided.
- Do not anchor tightly to mounting surface. Pipe must be allowed to move freely through hanger.
- Steel applications require two (2) #14 x 1" hex washer head self-drilling TEK screws. Not Supplied. Part Number STD-0090.

c UL us LISTED

Features:
- Beveled edge design helps protect the CPVC pipe from any rough surface.
- Easily attaches to wood structure with #10 x 1" hex washer head self threading screw supplied with product. No pre-drilling required.

Ordering: Specify CPVC pipe size, figure number and description.



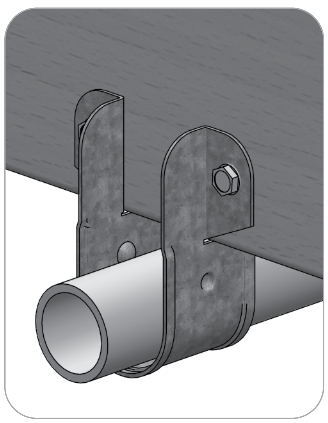


Fig. A

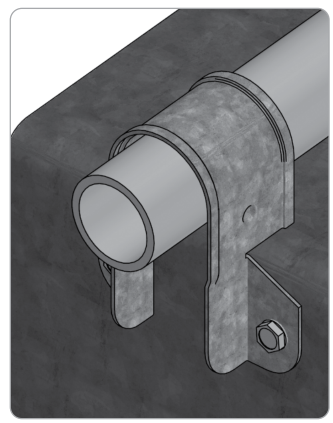


Fig. B

Fig. 187: Dimensions (in) • **Weight** (lbs)

CPVC Pipe Size	A	B	øC	E	F	Max. Hanger Spacing (ft.)	Approx. Weight/100 (lbs)
3/4	15/16	1 1/2	3/16	1 3/16	2 1/2	5 1/2	5
1	1	1 9/16	3/16	1 3/16	2 3/4	6	6
1 1/4	1 3/16	1 3/4	3/16	1 3/16	3 1/4	6 1/2	7
1 1/2	1 5/16	1 11/16	3/16	1 3/16	3 1/2	7	8
2	1 9/16	2 1/8	3/16	1 3/16	3 13/16	8	9

PROJECT INFORMATION	APPROVAL STAMP
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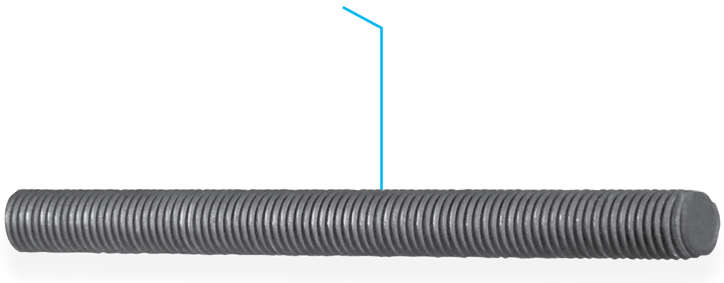
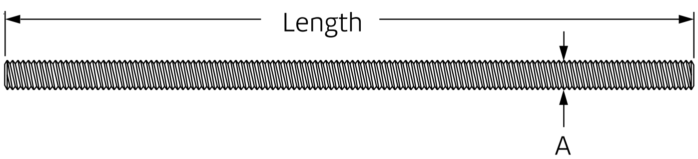
Engineer:	Remarks:
Submittal Date:	
Notes 1:	
Notes 2:	

ASC Engineered Solutions

Continuous Threaded Rod
Fig. 146 (Formerly Afcon Fig. 650)





Size Range: ¼" through 1½" stocked in six, ten, and twelve foot lengths. Other even foot lengths can be furnished to order.

Material: Carbon steel or Stainless Steel Gr 304

Threads: National Coarse (USS), rod threaded complete length.

Finish: ☐ Plain or ☐ Zinc Plated (Hot-Dip Galvanized optional)

Maximum Temperature:
Zinc Plated 450˚F, Stainless Steel 650˚ F

Approvals: Complies with MSS SP-58.

Ordering: Specify rod diameter and length, figure number,name and finish.

Note: The acceptability of galvanized coatings at temperatures above 450°F is at the discretion of the end user.

ANVIL
An ASC Engineered Solution

Fig. 146: Dimensions (in) • **Loads** (lbs) • **Weight** (lbs)

Rod Size A	Threads per Inch	Max Load 650˚ F	Weight per Ft.
¼	20	240	0.12
⅜	16	730	0.30
½	13	1,350	0.53
⅝	11	2,160	0.84
¾	10	3,230	1.20
⅞	9	4,480	1.70
1	8	5,900	2.30
1¼	7	9,500	3.60
1½	6	13,800	5.10

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ASC Engineered Solutions

Rod Couplings
Fig. 05-135

Description

FPPI rod couplings are zinc plated for corrosion resistance.

FPPI
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Notes 2:	

115 STANDARD DUTY LOOP HANGER

The 115 Standard Duty Loop Hanger is ideal for suspending stationary, non-insulated pipe lines, including CPVC pipes, in fire sprinkler systems. A knurled insert nut helps simplify vertical adjustments and flared edges on the base (1/2" to 4" sizes) help protect pipes from coming into contact with any sharp edges of the hanger.

CERTIFICATIONS

FEATURES

- Flared edges help prevent any sharp surfaces from coming into contact with the pipe (1/2" to 4" sizes)
- Retained insert nut helps ensure the loop hanger and insert nut stay together
- Recommended for the suspension of stationary non-insulated pipe lines
- Manufactured to use the minimum rod size permitted by NFPA® for fire sprinkler piping
- Conforms with Federal Specification WW-H-171 (Type 10), Manufacturers Standardization Society (MSS) SP-58 (Type 10)

SPECIFICATIONS

Finish: Pregalvanized

Material: Steel

Table 1/2

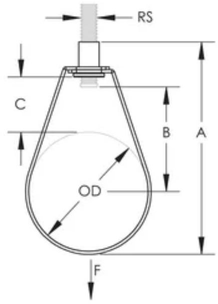
Catalog Number	Pipe Size	Outer Diameter (OD)	Rod Size (RS)	A	B	C
1150050EG	1/2"	0.84"	3/8"	2 13/16"	1 1/8"	1"
1150075EG	3/4"	1.05"	3/8"	3"	1 3/16"	15/16"
1150100EG	1"	1.31"	3/8"	3 1/4"	1 3/8"	15/16"
1150125EG	1 1/4"	1.66"	3/8"	3 9/16"	1 1/2"	15/16"

Catalog Number	Pipe Size	Outer Diameter (OD)	Rod Size(RS)	A	B	C
1150150EG	1 1/2"	1.9"	3/8"	3 13/16"	1 5/8"	15/16"
1150200EG	2"	2 3/8"	3/8"	4 1/4"	1 7/8"	15/16"
1150250EG	2 1/2"	2 7/8"	3/8"	5 15/16"	3 7/16"	2"
1150300EG	3"	3 1/2"	3/8"	6 9/16"	3 1/2"	1 15/16"
1150350EG	3 1/2"	4"	3/8"	7 1/16"	3 3/4"	1 15/16"
1150400EG	4"	4 1/2"	3/8"	7 9/16"	4"	1 15/16"
1150500EG	5"	5 9/16"	1/2"	9 13/16"	4 3/4"	2 1/4"
1150600EG	6"	6 5/8"	1/2"	11 5/16"	6 5/16"	3 5/16"
1150800EG	8"	8 5/8"	1/2"	12 7/8"	6 7/8"	2 7/8"

Table 2/2

Catalog Number	Static Load (F)	Certifications
1150050EG	300lb	cUL, UL
1150075EG	300lb	cUL, FM Approved, Pipe Hanger Components, UL
1150100EG	300lb	cUL, FM Approved, Pipe Hanger Components, UL
1150125EG	300lb	cUL, FM Approved, Pipe Hanger Components, UL
1150150EG	300lb	cUL, FM Approved, Pipe Hanger Components, UL
1150200EG	300lb	cUL, FM Approved, Pipe Hanger Components, UL
1150250EG	525lb	cUL, FM Approved, Pipe Hanger Components, UL
1150300EG	525lb	cUL, FM Approved, Pipe Hanger Components, UL
1150350EG	585lb	cUL, FM Approved, Pipe Hanger Components, UL
1150400EG	650lb	cUL, FM Approved, Pipe Hanger Components, UL
1150500EG	1000lb	cUL, FM Approved, Pipe Hanger Components, UL
1150600EG	1000lb	cUL, FM Approved, Pipe Hanger Components, UL
1150800EG	1000lb	cUL, FM Approved, Pipe Hanger Components, UL

DIAGRAMS



WARNING

nVent products shall be installed and used only as indicated in nVent's product instruction sheets and training materials. Instruction sheets are available at www.nvent.com and from your nVent customer service representative. Improper installation, misuse, misapplication or other failure to completely follow nVent's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death and/or void your warranty.

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510 NVENT CADDY EZ RISER

CERTIFICATIONS

FEATURES

Recommended for suspending vertical steel pipe risers
Slotted holes make assembly easy, eliminating loose hardware
Serrated flange-head bolts eliminate need for wrenches on both bolt and nut
Conforms with Federal Specification WW-H-171 (Type 8), Manufacturers Standardization Society (MSS) SP-58 (Type 8)

SPECIFICATIONS

Finish: Electrogalvanized

Material: Steel

Table 1/2

Catalog Number	Pipe Size	Outer Diameter (OD)	Hole Size (HS)	A	B	Static Load (F)
5100050EG	1/2"	0.84"	7/16"	8 1/2"	1"	255lb
5100075EG	3/4"	1.05"	7/16"	9"	1"	255lb
5100100EG	1"	1.31"	7/16"	9"	1"	255lb
5100125EG	1 1/4"	1.66"	7/16"	9 7/16"	1"	255lb
5100150EG	1 1/2"	1.9"	7/16"	9 7/8"	1"	255lb

Catalog Number	Pipe Size	Outer Diameter (OD)	Hole Size (HS)	A	B	Static Load (F)
5100200EG	2"	2 3/8"	7/16"	10 1/4"	1 3/16"	255lb
5100250EG	2 1/2"	2 7/8"	7/16"	11"	1 3/16"	390lb
5100300EG	3"	3 1/2"	7/16"	11 3/4"	1 3/16"	530lb
5100400EG	4"	4 1/2"	9/16"	13"	1 1/2"	810lb
5100500EG	5"	5 9/16"	9/16"	14 1/2"	1 1/2"	1160lb
5100600EG	6"	6 5/8"	9/16"	16"	2"	1570lb
5100800EG	8"	8 5/8"	11/16"	18 1/4"	2"	2500lb
5101000EG	10"	10 3/4"	11/16"	20 5/8"	2"	2500lb
5101200EG	12"	12 3/4"	11/16"	22 3/8"	2"	2700lb
5101400EG	14"	14"	11/16"	24 1/8"	2"	2700lb
5101600EG	16"	16"	13/16"	27 7/8"	2 1/2"	2900lb

Table 2/2

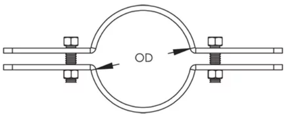
Catalog Number	Certifications
5100050EG	
5100075EG	
5100100EG	
5100125EG	
5100150EG	
5100200EG	cUL, ITB, UL
5100250EG	cUL, ITB, UL
5100300EG	cUL, ITB, UL
5100400EG	cUL, ITB, UL
5100500EG	cUL, UL
5100600EG	cUL, UL
5100800EG	cUL, UL
5101000EG	
5101200EG	
5101400EG	
5101600EG	

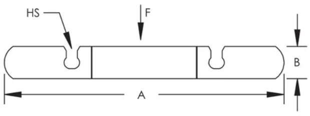
ADDITIONAL PRODUCT DETAILS

Clamp is fitted for steel pipe and should be installed below a coupling or shear lug, with bolts torqued to recommended value.

Slotted holes and bolts for pipe sizes up to 12" only.

DIAGRAMS





WARNING

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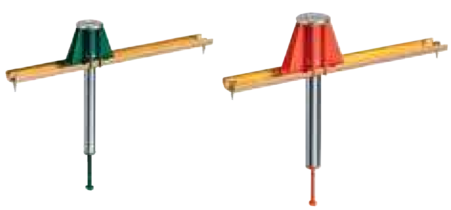
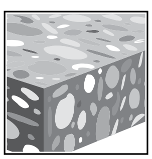
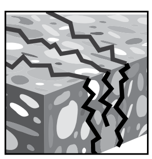
3.3.18 KCC-WF AND KCC-MD CAST-IN ANCHOR

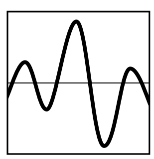
PRODUCT DESCRIPTION

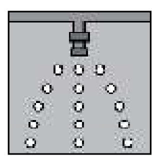
KCC-WF and KCC-MD cast-in anchors

Anchor System		Features and Benefits
	Internally threaded cast-in anchors for wood form construction (KCC-WF)	• Quick push-to-connect technology offers ultimate productivity • Ideal for pre-assembled / pre-fabricated hanger assemblies • KCC-WF — Color-coded foam covering protects inner threads from concrete intrusion • KCC-WF — Nails through the head helps prevent anchor from being knocked over and from head popping off due to rebar hits • KCC-MD SP and LP — Pre-assembled self-tapping screws reduce installation time • KCC-MD SP and LP — Color-coded plastic plugs protect inner threads from concrete, sprayed-on fireproofing, or sprayed-on insulation • KCC-MD LP — Pre-assembled spanner plate offers flexibility with installation at any location on the metal deck including the incline • KCC-MD LP — Anchor installs to the top of the flutes, so anchoring point is at consistent height throughout, which is ideal for pre-fabricated hangers
	Internally threaded short plate cast-in anchors for lightweight concrete over metal deck construction (KCC-MD SP)	
	Internally threaded long plate cast-in anchors for lightweight concrete over metal deck construction (KCC-MD LP)	


Uncracked concrete


Cracked concrete


Seismic Design Categories A-F


Fire sprinkler listings

Approvals/ Listings

ICC-ES (International Code Council) 2018 International Building Code / International Residential Code (IBC/IRC)	ESR-4145 in concrete per ACI 318 Ch. 17 / ICC-ES AC446
City of Los Angeles	2020 LABC Supplement (within ESR-4145)
Florida Building Code	2017 FBC with HVHZ
UL LLC (Underwriters Laboratory LLC)	Pipe Hanger Equipment for Fire Protection Services for 3/8 through 1/2 (See Table 28)
FM (Factory Mutual) Pipe	Hanger Components for Automatic Sprinkler Systems for 3/8 through 1/2 (See Table 28)

LISTED APPROVED

MATERIAL SPECIFICATIONS

KCC-WF and KCC-MD (short plate and long plate) have an insert body made from carbon steel with an engineered plastic flange. The insert body is zinc plated per ASTM B633 Fe/Zn 5 Type III.

INSTALLATION PARAMETERS

Table 1 — Hilti KCC-WF, KCC-MD SP and KCC-MD LP cast-in anchor installation information

Design Information	Symbol	Units	KCC-WF		KCC-MD SP		KCC-MD LP	
Insert thread	d	UNC	3/8-16	1/2-13	3/8-16	1/2-13	3/8-16	1/2-13
Plastic housing color	-	-	Dark Green	Dark Orange	Dark Green	Dark Orange	Dark Green	Dark Orange
Outside diameter of anchor steel body	d_a	in. (mm)	0.67 (17)	0.87 (22)	0.67 (17)	0.87 (22)	0.67 (17)	0.87 (22)
Bearing area	A_{brg}	in.^{2} (mm^2)	1.0 (643)	1.2 (774)	1.0 (643)	1.2 (774)	1.0 (643)	1.2 (774)
Effective embedment	h_{ef}	in. (mm)	1.63 (41)	2.04 (52)	2.00 (51)	2.50 (64)	2.00 (51)	2.50 (64)
Nominal embedment	h_{nom}	in. (mm)	1.76 (45)	2.17 (55)	2.13 (54)	2.63 (67)	2.21 (56)	2.71 (69)
Metal hole saw diameter	d_{bit}	in.	N/A	N/A	11/16	13/16	5/8	3/4
Steel head thickness	t_{sh}	mm	3.3					
Minimum member thickness — wood form installation	h_{min}	in. (mm)	2.5 (64)	3 (76)	N/A	N/A	N/A	N/A
Minimum concrete cover over metal deck — all installations (see Figures 5A, 5B, 5C and 5D)	$h_{deck,min}$	in. (mm)	N/A	N/A	2.5 (64)	3.25 (83)	2.5 (64)	3.25 (83)
Minimum metal deck gauge	-	-	N/A		20			
Minimum anchor spacing	S_{min}	in. (mm)	2.6 (67)	3.5 (88)	6.0 (152)	7.5 (191)	6.0 (152)	7.5 (191)
Minimum edge distance	C_{min}	in. (mm)	1.5 (38)	1.5 (38)	6.0 (152)	7.5 (191)	6.0 (152)	7.5 (191)
Thread engagement length — see Figure 4	l_{th}	in.	1.6	1.9	N/A	N/A	N/A	N/A
Thread engagement length Plastic on/ Metal tube on — see Figure 4	l_{th}	in.	N/A	N/A	4.3	4.7	6.9	7.3
Thread engagement length Plastic off — see Figure 4	l_{th}	in.	N/A	N/A	2.5	2.9	N/A	N/A

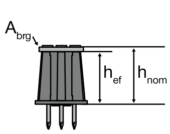


Figure 1 — KCC-WF

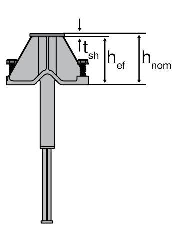


Figure 2 — KCC-MD SP

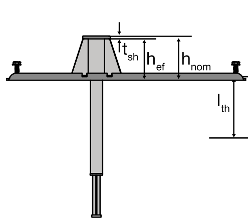


Figure 3 — KCC-MD LP

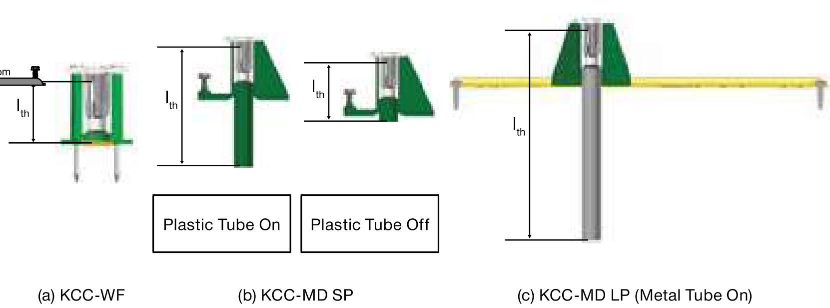


Figure 4 — KCC Thread Engagement Measurement

3.3.18

DESIGN INFORMATION IN CONCRETE PER ACI 318

ACI 318 Chapter 17

The technical data contained in this section are Hilti Simplified Tables. The load values were developed using the Strength Design parameters and variables of ESR-4145 and the equations within ACI 318 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8. Data tables from ESR-4145 are not contained in this section, but can be found at www.icc-es.org or at www.hilti.com.

Table 2 — Design strength for steel failure of KCC-WF inserts[1,2,3,4]

DESIGN INFORMATION	Symbol	Units	Insert type KCC-WF	
Nominal rod diameter	-	in.	3/8	1/2
Design steel strength of insert in tension	$\phi_{Nsa,insert}$	lb (kN)	2,625 (11.7)	3,515 (15.6)
Design seismic steel strength of insert in tension	$\phi_{Nsa,insert,eq}$	lb (kN)	2,625 (11.7)	3,515 (15.6)
Design steel strength of insert in shear	$\phi_{Vsa,insert}$	lb (kN)	3,220 (14.3)	3,340 (14.9)
Design seismic steel strength of insert in shear	$\phi_{Vsa,insert}$	lb (kN)	3,220 (14.3)	3,340 (14.9)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Hilti KCC-WF Inserts are considered brittle steel elements
3 Values are for the insert only. The capacity of the threaded rod must be also be determined from Table 16. The design strength of concrete must be in accordance with ACI 318 Chapter 17 and Tables 3 to 4 as necessary. Compare the values (threaded rod, inserts, and concrete). The lesser of the values is to be used for the design.
4 Only threaded rods ASTM A193 Grade B7, ASTM A325, or ASTM F1554 Grade 105 are allowed to be used for applocations resisting shear, seismic shear or seismic tension loads.

Table 3 — Hilti KCC-WF cast-in insert design strength with concrete / pullout failure in uncracked concrete [1,2,3,4,5,6]

Nominal anchor internal diameter	Effective embedment depth in. (mm)	Tension - ΦN_n f'_c = 2,500 psi (17.2 MPa) lb (kN)	Tension - ΦN_n f'_c = 3,000 psi (20.7 MPa) lb (kN)	Tension - ΦN_n f'_c = 4,000 psi (27.6 MPa) lb (kN)	Tension - ΦN_n f'_c = 6,000 psi (41.1 MPa) lb (kN)	Shear - ΦV_n f'_c = 2,500 psi (17.2 MPa) lb (kN)	Shear - ΦV_n f'_c = 3,000 psi (20.7 MPa) lb (kN)	Shear - ΦV_n f'_c = 4,000 psi (27.6 MPa) lb (kN)	Shear - ΦV_n f'_c = 6,000 psi (41.1 MPa) lb (kN)
3/8"	1.63 (41)	2,185 (9.7)	2,390 (10.6)	2,760 (12.3)	3,385 (15.1)	2,185 (9.7)	2,390 (10.6)	2,760 (12.3)	3,385 (15.1)
1/2"	2.04 (52)	3,055 (13.6)	3,350 (14.9)	3,865 (17.2)	4,735 (21.1)	3,055 (13.6)	3,350 (14.9)	3,865 (17.2)	4,735 (21.1)

Table 4 — Hilti KCC-WF cast-in insert design strength with concrete / pullout failure in cracked concrete [1,2,3,4,5,6]

Nominal anchor internal diameter	Effective embedment depth in. (mm)	Tension - ΦN_n f'_c = 2,500 psi (17.2 MPa) lb (kN)	Tension - ΦN_n f'_c = 3,000 psi (20.7 MPa) lb (kN)	Tension - ΦN_n f'_c = 4,000 psi (27.6 MPa) lb (kN)	Tension - ΦN_n f'_c = 6,000 psi (41.1 MPa) lb (kN)	Shear - ΦV_n f'_c = 2,500 psi (17.2 MPa) lb (kN)	Shear - ΦV_n f'_c = 3,000 psi (20.7 MPa) lb (kN)	Shear - ΦV_n f'_c = 4,000 psi (27.6 MPa) lb (kN)	Shear - ΦV_n f'_c = 6,000 psi (41.1 MPa) lb (kN)
3/8"	1.63 (41)	1,745 (7.8)	1,910 (8.5)	2,210 (9.8)	2,705 (12.0)	1,745 (7.8)	1,910 (8.5)	2,210 (9.8)	2,705 (12.0)
1/2"	2.04 (52)	2,445 (10.9)	2,680 (11.9)	3,095 (13.8)	3,790 (16.9)	2,445 (10.9)	2,680 (11.9)	3,095 (13.8)	3,790 (16.9)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular values are for single anchors located at edge distance (c) and spacing (s) greater than $3h_{ef}$. For anchors with edge distance or spacing less than $3h_{ef}$ use ACI 318 to calculate load reduction factor. Compare the calculated value to the steel values (threaded rod and inserts) in Tables 16 and 2. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.85. For all-lightweight, λ_a = 0.75.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. No reduction needed for seismic shear.
6 Compare tabular value to the insert steel strength values in Table 2 and threaded rod steel strength values in Table 16 The lesser of the values is to be used for the design.

Table 5 — Load adjustment factors for KCC-WF 3/8" in uncracked concrete [1,2]

KCC-WF 3/8" uncracked concrete		Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear [3] f_{AV}	Edge distance in shear ⊥ Toward edge f_{RV}	Edge distance in shear ∥ To edge f_{RV}	Concrete thickness factor in shear [4] f_{HV}
Embedment h_{ef}	in (mm)	1.63 (41)	1.63 (41)	1.63 (41)	1.63 (41)	1.63 (41)	1.63 (41)
Min. conc. thickness h_{min} (in.)		2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	1-1/2 (38)	n/a	0.713	n/a	0.282	0.564	n/a
	2 (51)	n/a	0.859	n/a	0.434	0.859	n/a
	2-1/2 (64)	n/a	1.000	n/a	0.607	1.000	0.691
	2-5/8 (67)	0.768		0.625	0.653		0.708
	3 (76)	0.807		0.643	0.798		0.757
	3-1/2 (89)	0.858		0.667	1.000		0.818
	4 (102)	0.909		0.691			0.874
	4-1/2 (114)	0.960		0.715			0.927
	5 (127)	1.000		0.739			0.978
	5-1/2 (140)			0.763			1.000
	6 (152)			0.787			
	7 (178)			0.834			
	8 (203)			0.882			
	10 (254)			0.978			
	12 (305)			1.000			

Table 6 — Load adjustment factors for KCC-WF 3/8" in cracked concrete [1,2]

KCM-WF 1/4"-3/8" cracked concrete		Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear [3] f_{AV}	Edge distance in shear ⊥ Toward edge f_{RV}	Edge distance in shear ∥ To edge f_{RV}	Concrete thickness factor in shear [4] f_{HV}
Embedment h_{ef}	in (mm)	1.63 (41)	1.63 (41)	1.63 (41)	1.63 (41)	1.63 (41)	1.63 (41)
Min. conc. thickness h_{min} (in.)		2-1/2	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	1-1/2 (38)	n/a	0.713	n/a	0.252	0.504	n/a
	2 (51)	n/a	0.859	n/a	0.388	0.775	n/a
	2-1/2 (64)	n/a	1.000	n/a	0.542	1.000	0.666
	2-5/8 (67)	0.768		0.616	0.583		0.682
	3 (76)	0.807		0.633	0.712		0.729
	3-1/2 (89)	0.858		0.655	0.897		0.788
	4 (102)	0.909		0.677	1.000		0.842
	4-1/2 (114)	0.960		0.699			0.893
	5 (127)	1.000		0.722			0.941
	5-1/2 (140)			0.744			0.987
	6 (152)			0.766			1.000
	7 (178)			0.810			
	8 (203)			0.854			
	10 (254)			0.943			
	12 (305)			1.000			

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17 (or CSA A23.3 (R2014) Annex D).
3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

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Table 7 — Load adjustment factors for KCC-WF 1/2" in uncracked concrete [1,2]

KCM-WF 1/2" uncracked concrete			Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear [3] f_{AV}	Edge distance in shear ⊥ Toward edge f_{RV}	Edge distance in shear ∥ To edge f_{RV}	Concrete thickness factor in shear [4] f_{HV}
Embedment h_{ef}		in (mm)	2.04 (52)	2.04 (52)	2.04 (52)	2.04 (52)	2.04 (52)	2.04 (52)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	1-1/2	(38)	n/a	0.631	n/a	0.281	0.561	n/a
	2	(51)	n/a	0.741	n/a	0.432	0.741	n/a
	2-1/2	(64)	n/a	0.859	n/a	0.604	0.859	n/a
	3	(76)	n/a	0.984	n/a	0.794	0.984	0.756
	3-1/2	(89)	0.786	1.000	0.667	1.000	1.000	0.817
	4	(102)	0.827		0.691			0.873
	4-1/2	(114)	0.868		0.714			0.926
	5	(127)	0.908		0.738			0.976
	5-1/2	(140)	0.949		0.762			1.000
	5-3/4	(146)	0.970		0.774			
	6	(152)	0.990		0.786			
	7	(178)	1.000		0.833			
	8	(203)			0.881			
	9	(229)			0.929			
	10	(254)			0.976			
	12	(305)			1.000			

Table 8 — Load adjustment factors for KCC-WF 1/2" in cracked concrete [1,2]

KCM-WF 3/8"-1/2" cracked concrete			Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear [3] f_{AV}	Edge distance in shear ⊥ Toward edge f_{RV}	Edge distance in shear ∥ To edge f_{RV}	Concrete thickness factor in shear [4] f_{HV}
Embedment h_{ef}		in (mm)	2.04 (52)	2.04 (52)	2.04 (52)	2.04 (52)	2.04 (52)	2.04 (52)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	1-1/2	(38)	n/a	0.631	n/a	0.251	0.501	n/a
	2	(51)	n/a	0.741	n/a	0.386	0.741	n/a
	2-1/2	(64)	n/a	0.859	n/a	0.539	0.859	n/a
	3	(76)	n/a	0.984	n/a	0.709	0.984	0.728
	3-1/2	(89)	0.786	1.000	0.655	0.893	1.000	0.786
	4	(102)	0.827		0.677	1.000		0.841
	4-1/2	(114)	0.868		0.699			0.892
	5	(127)	0.908		0.721			0.940
	5-1/2	(140)	0.949		0.743			0.986
	5-3/4	(146)	0.970		0.754			1.000
	6	(152)	0.990		0.765			
	7	(178)	1.000		0.809			
	8	(203)			0.853			
	9	(229)			0.898			
	10	(254)			0.942			
	12	(305)			1.000			

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use PROFIS Engineering or perform anchor calculation using design equations from ACI 318 Chapter 17 (or CSA A23.3 (R2014) Annex D).
3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

Table 9 — Design strength for steel failure of KCC-MD Short Plate and Long Plate inserts [1,2,3,4,5]

Design information	Symbol	Units	Insert Type			
			SP 3/8"	SP 1/2"	LP 3/8"	LP 1/2"
Nominal rod diameter		in.	3/8	1/2	3/8	1/2
Design steel strength of insert in tension	$\phi N_{sa,insert}$	lb	2,625	3,515	2,625	3,515
		(kN)	(11.7)	(15.6)	(11.7)	(15.6)
Design seismic steel strength of insert in tension	$\phi N_{sa,insert,eq}$	lb	2,625	3,515	2,625	3,515
		(kN)	(11.7)	(15.6)	(11.7)	(15.6)
Installations in upper flute of metal deck (i.e. W-deck and B-deck) according to Figure 5A						
Design steel strength of insert in shear	$\phi_{Vsa,insert}$	lb	3,045	3,615	3,045	3,615
		(kN)	(13.6)	(16.1)	(13.6)	(16.1)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert,eq}$	lb	3,045	5,735	3,045	5,735
		(kN)	(13.6)	(25.5)	(13.6)	(25.5)
Installations in lower flute of metal deck (i.e. W-deck) according to Figure 5B						
Design steel strength of insert in shear	$\phi V_{sa,insert}$	lb	2,235	2,720	3,220	3,615
		(kN)	(9.9)	(12.1)	(14.3)	(16.1)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert,eq}$	lb	2,235	2,720	3,220	3,615
		(kN)	(9.9)	(12.1)	(14.3)	(16.1)
Installations in lower flute of metal deck (i.e. B-deck) according to Figure 5C						
Design steel strength of insert in shear	$\phi V_{sa,insert}$	lb	2,050	2,380	3,130	3,615
		(kN)	(9.1)	(11)	(13.9)	(16.1)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert,eq}$	lb	2,050	2,380	3,130	3,615
		(kN)	(9.1)	(11)	(13.9)	(16.1)
Installations over flute incline of metal deck (i.e. W-deck) according to Figure 5D						
Design steel strength of insert in shear	$\phi V_{sa,insert}$	lb	N/A		1,120	2,890
		(kN)			(5.0)	(12.9)
Design seismic steel strength of insert in shear	$\phi V_{sa,insert,eq}$	lb			1,120	2,310
		(kN)			(5.0)	(10.3)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Hilti KCC-MD Inserts are considered brittle steel elements
3 Tension values are for the inserts only. The capacity of the threaded rods must be also determined from Table 16. The design strength of concrete must be obtained from tables 10 to 15. Compare the tension values of threaded rod, inserts, and concrete. The lesser of the values is to be used for the design.
4 Shear values are for the inserts only. The capacity of the threaded rods must be also determined from Table 16. The calculation of concrete shear strength is not required. Compare the shear values of threaded rod and inserts. The lesser of the values is to be used for the design strength of the anchor in shear.
5 Only threaded rod ASTM A193 Grade B7, ASTM A325, or ASTM F1554 Grade 105 is permitted to be used for the applications resisting shear, seismic shear, or seismic tension loads.

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Table 10 — Hilti KCC Short Plate and Long Plate tension design strength in the soffit of uncracked sand-lightweight concrete over metal deck (B profile) [1,2,3,4,5,6,7,8]

Anchor	Nominal Embed. Depth in. (mm)	Upper flute per Figure 4A		Lower flute per Figure 4C	
		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
SP 3/8”	2.13 (54)	3,610 (16.1)	4,170 (18.5)	635 (2.8)	735 (3.3)
SP 1/2”	2.63 (67)	4,580 (20.4)	5,290 (23.5)	695 (3.1)	805 (3.6)
LP 3/8”	2.21 (56)	3,610 (16.1)	4,170 (18.5)	3,610 (16.1)	4,170 (18.5)
LP 1/2”	2.71 (69)	4,580 (20.4)	5,290 (23.5)	4,580 (20.4)	5,290 (23.5)

Table 11 — Hilti KCC-MD Short Plate and Long Plate tension design strength in the soffit of cracked sand-lightweight concrete over metal deck (B profile) [1,2,3,4,5,6,7,8]

Anchor	Nominal Embed. Depth in. (mm)	Upper flute per Figure 4A		Lower flute per Figure 4C	
		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
SP 3/8”	2.13 (54)	2,890 (12.9)	3,335 (14.8)	505 (2.2)	585 (2.6)
SP 1/2”	2.63 (67)	3,660 (16.3)	4,225 (18.8)	555 (2.5)	640 (2.8)
LP 3/8”	2.21 (56)	2,890 (12.9)	3,335 (14.8)	2,890 (12.9)	3,335 (14.8)
LP 1/2”	2.71 (69)	3,660 (16.3)	4,225 (18.8)	3,660 (16.3)	4,225 (18.8)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x hef (effective embedment).
4 Tabular values are for normal weight or sand-light weight concrete.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Compare tabular value to the insert steel strength values in Table 9 and threaded rod steel strength values in Table 16. The lesser of the values is to be used for the design.
7 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.19, Section 3.1.8.7 for additional information on seismic applications.
8 For Hilti KCC-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 9 for shear calculations.

Table 12 — Hilti KCC-MD Short Plate and Long Plate tension design strength in the soffit of uncracked sand-lightweight concrete over metal deck (W profile with 3-7/8" width) [1,2,3,4,5,6,7,8]

Anchor	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5B		Inclined per Figure 5D	
		Tension - ΦN_n		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
SP 3/8"	2.13 (54)	3,610 (16.1)	4,170 (18.5)	1,850 (8.2)	2,135 (9.5)	-	-
SP 1/2"	2.63 (67)	4,580 (20.4)	5,290 (23.5)	2,120 (9.4)	2,450 (10.9)	-	-
LP 3/8"	2.21 (56)	3,610 (16.1)	4,170 (18.5)	4,895 (21.8)	5,650 (25.1)	3,610 (16.1)	4,170 (18.5)
LP 1/2"	2.71 (69)	4,580 (20.4)	5,290 (23.5)	6,565 (29.2)	7,580 (33.7)	4,580 (20.4)	5,290 (23.5)

Table 13 — Hilti KCC-MD Short Plate and Long Plate tension design strength in the soffit of cracked sand-lightweight concrete over metal deck (W profile with 3-7/8" width) [1,2,3,4,5,6,7,8]

Anchor	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5B		Inclined per Figure 5D	
		Tension - ΦN_n		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
SP 3/8"	2.13 (54)	2,890 (12.9)	3,335 (14.8)	1,480 (6.6)	1,710 (7.6)	-	-
SP 1/2"	2.63 (67)	3,660 (16.3)	4,225 (18.8)	1,695 (7.5)	1,955 (8.7)	-	-
LP 3/8"	2.21 (56)	2,890 (12.9)	3,335 (14.8)	3,915 (17.4)	4,520 (20.1)	2,890 (12.9)	3,335 (14.8)
LP 1/2"	2.71 (69)	3,660 (16.3)	4,225 (18.8)	5,250 (23.4)	6,060 (27.0)	3,660 (16.3)	4,225 (18.8)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
4 Tabular values are for normal weight or sand-light weight concrete.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Compare tabular value to the insert steel strength values in Table 9 and threaded rod steel strength values in Table 16. The lesser of the values is to be used for the design.
7 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.19, Section 3.1.8.7 for additional information on seismic applications.
8 For Hilti KCC-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 9 for shear calculations.

Table 14 — Hilti KCC-MD Short Plate and Long Plate tension design strength in the soffit of uncracked sand-lightweight concrete over metal deck (W profile with 4-1/2” width) [1,2,3,4,5,6,7,8]

Anchor	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5B		Inclined per Figure 5D	
		Tension - ΦN_n		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
SP 3/8”	2.13 (54)	3,610 (16.1)	4,170 (18.5)	1,850 (8.2)	2,135 (9.5)	-	-
SP 1/2”	2.63 (67)	4,580 (20.4)	5,290 (23.5)	2,120 (9.4)	2,450 (10.9)	-	-
LP 3/8”	2.21 (56)	3,610 (16.1)	4,170 (18.5)	4,895 (21.8)	5,650 (25.1)	3,610 (16.1)	4,170 (18.5)
LP 1/2”	2.71 (69)	4,580 (20.4)	5,290 (23.5)	6,565 (29.2)	7,580 (33.7)	4,580 (20.4)	5,290 (23.5)

Table 15 — Hilti KCC-MD Short Plate and Long Plate tension design strength in the soffit of cracked sand-lightweight concrete over metal deck (W profile with 4-1/2” width) [1,2,3,4,5,6,7,8]

Anchor	Nominal Embed. Depth in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5B		Inclined per Figure 5D	
		Tension - ΦN_n		Tension - ΦN_n		Tension - ΦN_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
SP 3/8”	2.13 (54)	2,890 (12.9)	3,335 (14.8)	1,480 (6.6)	1,710 (7.6)	-	-
SP 1/2”	2.63 (67)	3,660 (16.3)	4,225 (18.8)	1,695 (7.5)	1,955 (8.7)	-	-
LP 3/8”	2.21 (56)	2,890 (12.9)	3,335 (14.8)	3,915 (17.4)	4,520 (20.1)	2,890 (12.9)	3,335 (14.8)
LP 1/2”	2.71 (69)	3,660 (16.3)	4,225 (18.8)	5,250 (23.4)	6,060 (27.0)	3,660 (16.3)	4,225 (18.8)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
4 Tabular values are for normal weight or sand-light weight concrete.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Compare tabular value to the insert steel strength values in Table 9 and threaded rod steel strength values in Table 16. The lesser of the values is to be used for the design.
7 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.19, Section 3.1.8.7 for additional information on seismic applications.
8 For Hilti KCC-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 9 for shear calculations.

Table 16 — Design strength for steel failure of common threaded rods [1,5]

Nominal anchor diameter	Grade A36 threaded rod			ASTM A 193 B7 or ASTM F1554 Gr. 105 threaded rod			ASTM A 307, Grade A threaded rod		
	Tensile[2] $\phi N_{sa,rod}$ or $\phi N_{sa,eq,rod}$ lb (kN)	Shear[3] $\phi V_{sa,rod}$ lb (kN)	Seismic Shear[4] $\phi V_{sa,eq,rod}$ lb (kN)	Tensile[2] $\phi N_{sa,rod}$ or $\phi N_{sa,eq,rod}$ lb (kN)	Shear[3] $\phi V_{sa,rod}$ lb (kN)	Seismic Shear[4] $\phi V_{sa,eq,rod}$ lb (kN)	Tensile[2] $\phi N_{sa,rod}$ or $\phi N_{sa,eq,rod}$ lb (kN)	Shear[3] $\phi V_{sa,rod}$ lb (kN)	Seismic Shear[4] $\phi V_{sa,eq,rod}$ lb (kN)
3/8	3,395 (15.1)	1,750 (7.8)	1,225 (5.4)	7,315 (32.5)	3,780 (16.8)	2,646 (11.8)	3,490 (15.5)	1,815 (8.1)	1,271 (5.7)
1/2	6,175 (27.5)	3,210 (14.3)	2,245 (10.0)	13,315 (59.2)	6,915 (30.8)	4,841 (21.5)	6,375 (28.4)	3,315 (14.7)	2,321 (10.3)

1 See PTG Ed. 19, Section 3.1.8.7 for additional information on seismic applications.
2 Tensile values determined by static tension tests with $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Chapter 17.
3 Shear values determined by static shear tests with $\phi V_{sa} = \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17.
4 Seismic shear values determined by seismic shear tests with ϕ Vsa ≤ $\phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318, Chapter 17.
5 Values are for the threaded rod only. The capacity of the insert must be also be determined from Tables 2 and 9. The design strength of concrete must be in accordance with ACI 318 Chapter 17 and Tables 10 to 15 as necessary. Compare the values (threaded rod, inserts, and concrete). The lesser of the values is to be used for the design.

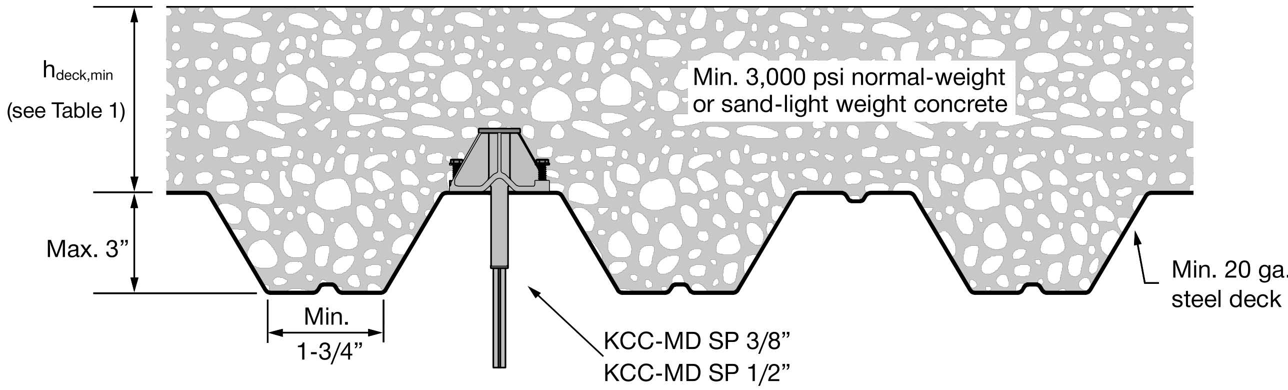

Figure 5A — Installation of KCC-MD inserts in the soffit of concrete filled metal deck floor and roof assemblies-over upper flute (B-deck and W-deck)

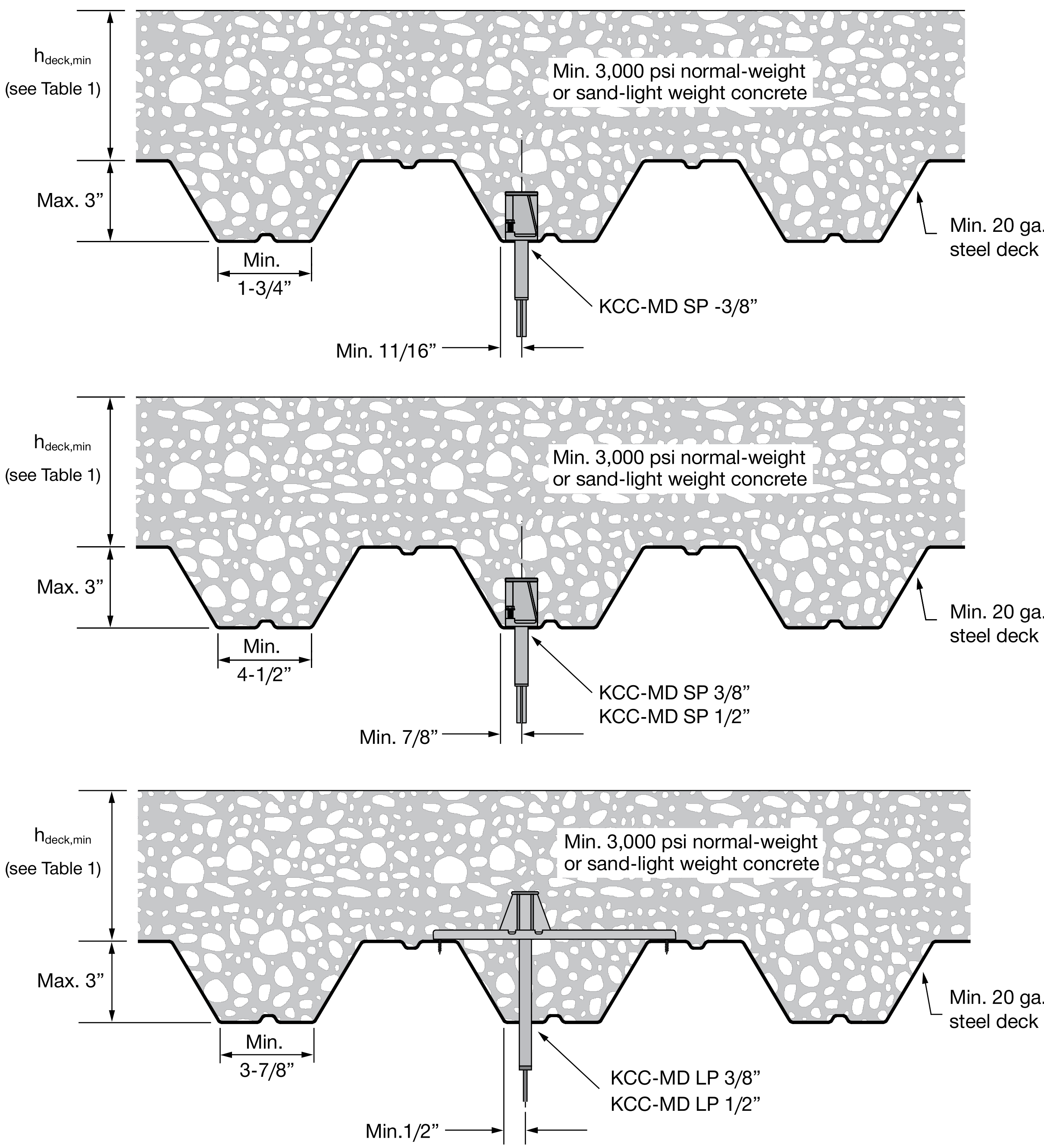

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Figure 5B —Installation of KCC-MD inserts in the soffit of concrete filled metal deck floor and roof assemblies-over lower flute (W-deck)

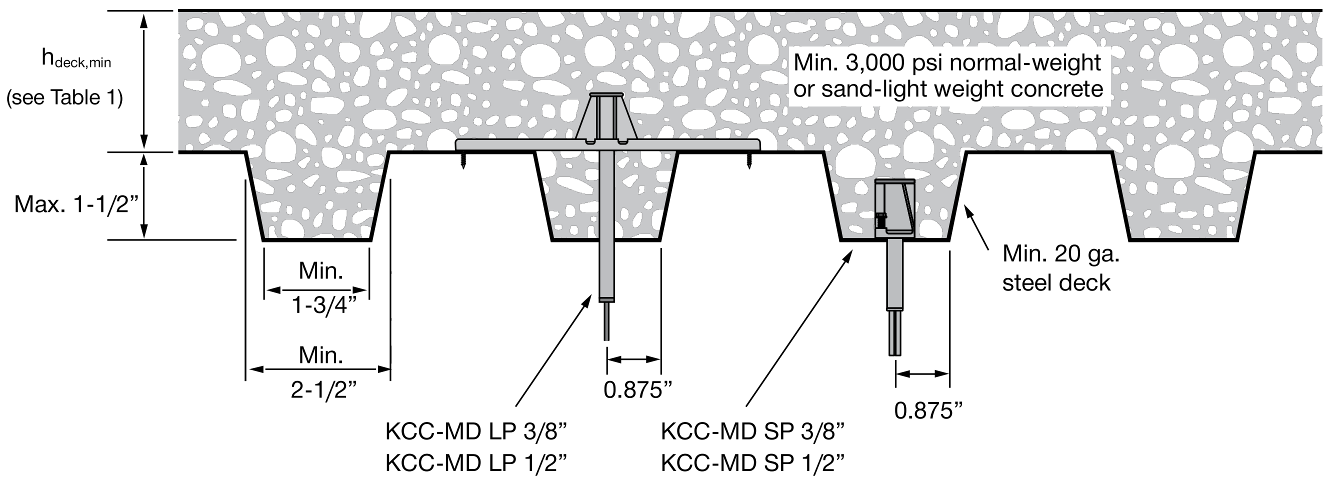

Figure 5C — Installation of KCC-MD inserts in the soffit of concrete filled metal deck floor and roof assemblies-over lower flute (B-deck)

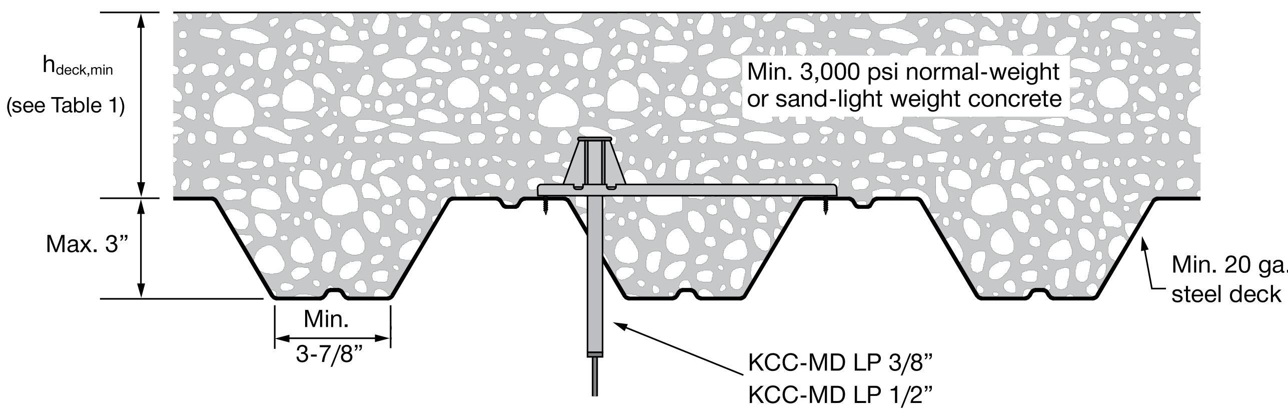

Figure 5D — Installation of KCC-MD inserts in the soffit of concrete filled metal deck floor and roof assemblies-over flute incline (W-deck)

DESIGN DATA IN CONCRETE PER CSA A23.3

CSA A23.3 Annex D Design

Limit State Design of anchors is described in the provisions of CSA A23.3 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. This section contains the Limit State Design tables with unfactored characteristic loads that are based on the published loads in ICC Evaluation Services ESR-4145. These tables are followed by factored resistance tables. The factored resistance tables have characteristic design loads that are prefactored by the applicable reduction factors for a single anchor with no anchor-to-anchor spacing of edge distance adjustments for the convenience of the user of this document. All the figures in the previous ACI 318 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

For a detailed explanation of the tables developed in accordance with CSA A23.3 Annex D, refer to PTG ED. 19, Section 3.1.8. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.ca.

Table 17 — Hilti KCC-WF insert design information in accordance with CSA A23.3 (R2014) Annex D [1,4]

Design parameter	Symbol	Units	Nominal anchor diameter		Ref A23.3-14
			3/8"	1/2"	
Outside diameter of anchor steel body	d_a	in. (mm)	0.67 (17)	0.87 (22)	
Effective embedment	h_{ef}	in. (mm)	1.63 (41)	2.04 (52)	
Minimum member thickness	h_{min}	in. (mm)	2.5 (51)	3 (76)	
Minimum edge distance	c_{min}	in. (mm)	1-1/2 (38)		
Minimum anchor spacing	s_{min}	*in.* (mm)	2.6 (67)	3.5 (88)	
Steel embed. material resistance factor for reinforcement	Φ_s	-	0.85		8.4.3
Resistance modification factor for tension, steel failure modes [2]	R	-	0.70		D.5.3
Resistance modification factor for shear, steel failure modes [2]	R	-	0.65		D.5.3
Factored steel resistance in tension	N_{sar}	lb (kN)	2,404 (10.7)	3,219 (14.3)	D.6.1.2
Factored steel resistance in tension, seismic	$N_{sar,eq}$	lb (kN)	2,404 (10.7)	3,219 (14.3)	D.6.1.2
Factored steel resistance in shear	V_{sar}	lb (kN)	2,735 (12.2)	3,075 (13.7)	D.7.1.2
Factored steel resistance in shear, seismic	$V_{sar,eq}$	lb (kN)	2,735 (12.2)	3,075 (13.7)	D.7.1.2
Coeff. for factored conc. breakout resistance, uncracked concrete	$k_{c,uncr}$	-	10		D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$	-	10		D.6.2.2
Modification factor for anchor resistance, tension, uncracked conc.	$\Psi_{c,N}$	-	1.25		D.6.2.6
Modification factor for anchor resistance, tension, cracked conc.	$\Psi_{c,N}$		1.0		D.6.2.6
Anchor category	-	-	cast-in		D.5.3 (c)
Concrete material resistance factor	Φ_c	-	0.65		8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B [3]	R	-	1.00		D.5.3 (c)

1 Design information in this table is taken from ICC-ES ESR-4145, and converted for use with CSA A23.3 (R2014) Annex D.
2 The carbon steel KCC-WF is considered a brittle steel element as defined by CSA A23.3 (R2014) Annex D section D.2.
3 For use with the load combinations of CSA A23.3 (R2014) chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 (R2014) section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.
4 Values are for the insert only. The capacity of the threaded rod must be also be determined from Table 27. The design strength of concrete must be in accordance with CSA A23.3 (R2014) and Tables 18 to 19 as necessary. Compare the values (threaded rod, inserts, and concrete). The lesser of the values is to be used for the design.

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Table 18 — Hilti KCC-WF cast-in insert design strength with concrete / pullout failure in uncracked concrete [1,2,3,4,5,6]

Nominal anchor internal diameter	Effective embedment depth in. (mm)	Tension - ΦN_n				Shear - ΦV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)
3/8"	1.63	2,185	2,390	2,760	3,385	2,185	2,390	2,760	3,385
	(41)	(9.7)	(10.6)	(12.3)	(15.1)	(9.7)	(10.6)	(12.3)	(15.1)
1/2"	2.04	3,055	3,350	3,865	4,735	3,055	3,350	3,865	4,735
	(52)	(13.6)	(14.9)	(17.2)	(21.1)	(13.6)	(14.9)	(17.2)	(21.1)

Table 19 — Hilti KCC-WF cast-in insert design strength with concrete / pullout failure in cracked concrete [1,2,3,4,5,6]

Nominal anchor internal diameter	Effective embedment depth in. (mm)	Tension - ΦN_n				Shear - ΦV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)
3/8"	1.63	1,745	1,910	2,210	2,705	1,745	1,910	2,210	2,705
	(41)	(7.8)	(8.5)	(9.8)	(12.0)	(7.8)	(8.5)	(9.8)	(12.0)
1/2"	2.04	2,445	2,680	3,095	3,790	2,445	2,680	3,095	3,790
	(52)	(10.9)	(11.9)	(13.8)	(16.9)	(10.9)	(11.9)	(13.8)	(16.9)

1 See PTG Ed. 19, Section 3.1.8.6 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular values are for single anchors located at edge distance (c) and spacing (s) greater than $3h_{ef}$. For anchors with edge distance or spacing less than $3h_{ef}$ use ACI 318 to calculate load reduction factor. Compare the calculated value to the steel values (threaded rod and inserts) in Tables 17 and 27. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
For sand-lightweight, λ_a = 0.85. For all-lightweight, λ_a = 0.75.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. No reduction needed for seismic shear.
6 Compare tabular value to the insert steel strength values in Table 17 and threaded rod steel strength values in Table 27 The lesser of the values is to be used for the design.

Table 20 — Design strength for steel failure of KCC-MD Short Plate and Long Plate inserts [1,2,3,4,5]

Design information	Symbol	Units	Insert Type			
			SP 3/8”	SP 1/2”	LP 3/8”	LP 1/2”
Nominal rod diameter (in.)	-	in.	3/8	1/2	3/8	1/2
Anchor O.D.	d_a	in. (mm)	0.67 (17)	0.87 (22)	0.67 (17)	0.87 (22)
Effective embedment	h_{ef}	in. (mm)	2.00 (51)	2.50 (64)	2.00 (51)	2.50 (64)
Min. specified ult. Strength, f_{ut} lb (kN)	f_{ut}	lb (kN)	4,040 (18.0)	5,410 (24.1)	4,040 (18.0)	5,410 (24.1)
Anchor category	-	-	Cast-In			
Concrete material resistance factor	ϕ_c	-	0.65			
Resistance modification factor for tension and shear, concrete failure modes, Condition B	R	-	1.00			
Steel embed. material resistance factor for reinforcement	ϕ_s	-	0.85			
Resistance modification factor for tension, steel failure modes	R	-	0.70			
Resistance modification factor for shear, steel failure modes	R	-	0.65			
Factored steel strength of insert in tension,	$\phi_{Nsa,insert}$	lb (kN)	2,405 (10.7)	3,220 (14.3)	2,405 (10.7)	3,220 (14.3)
Factored seismic steel strength of insert in tension	$\phi_{Nsa,insert,eq}$	lb (kN)	2,405 (11)	3,220 (14)	2,405 (11)	3,220 (14.3)
Installations in upper flute of metal deck (i.e. W-deck and B-deck) according to Figures 5A						
Factored steel strength of insert in shear	$\phi_{Vsa,insert}$	lb (kN)	2,590 (12)	3,075 (14)	2,590 (12)	3,075 (14)
Factored seismic steel strength of insert in shear	$\phi_{Vsa,insert,eq}$	lb (kN)	2,590 (12)	4,875 (22)	2,590 (12)	4,875 (22)
Installations in lower flute of metal deck (i.e. W-deck) according to Figures 5B						
Factored steel strength of insert in shear	$\phi_{Vsa,insert}$	lb (kN)	1,900 (8)	2,310 (10)	2,735 (12)	3,075 (14)
Factored seismic steel strength of insert in shear	$\phi_{Vsa,insert,eq}$	lb (kN)	1,900 (8)	2,310 (10)	2,735 (12)	3,075 (14)
Installations in lower flute of metal deck (i.e. B-deck) according to Figures 5C						
Factored steel strength of insert in shear	$\phi_{Vsa,insert}$	lb (kN)	1,745 (8)	2,190 (10)	2,660 (12)	3,075 (14)
Factored seismic steel strength of insert in shear	$\phi_{Vsa,insert,eq}$	lb (kN)	1,745 (8)	2,190 (10)	2,660 (12)	3,075 (14)
Installations in lower flute of metal deck (i.e. W-deck) according to Figures 5D						
Factored steel strength of insert in shear	$\phi_{Vsa,insert}$	lb (kN)	N/A		950 (4)	2,455 (11)
Factored seismic steel strength of insert in shear	$\phi_{Vsa,insert,eq}$	lb (kN)			950 (4)	1,965 (9)

1 Design information in this table is taken from ICC-ES ESR-4145, Table 4, and converted for use with CSA A23.3 (R2014) Annex D.
2 The carbon steel KCC-MD is considered a brittle steel element as defined by CSA A23.3 (R2014) Annex D section D.2.
3 Tension values are for the inserts only. The capacity of the threaded rods must be also determined from Table 27. The design strength of concrete must be obtained from tables 21-27. Compare the tension values of threaded rod, inserts, and concrete. The lesser of the values is to be used for the design.
4 Shear values are for the inserts only. The capacity of the threaded rods must be also determined from Table 27. The calculation of concrete shear strength is not required. Compare the shear values of threaded rod and inserts. The lesser of the values is to be used for the design strength of the anchor in shear.
5 Only threaded rod ASTM A193 Grade B7, ASTM A325, or ASTM F1554 Grade 105 is permitted to be used for the applications resisting shear, seismic shear, or seismic tension loads.

Table 21 — Hilti KCC-MD Short Plate and Long Plate factored tension resistance in the soffit of uncracked sand-lightweight concrete over metal deck (B profile) [1,2,3,4,5,6,7,8]

Anchor	Nominal embed. in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5C	
		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
SP 3/8”	2.13 (54)	3,300 (14.7)	4,040 (18.0)	580 (2.6)	710 (3.2)
SP 1/2”	2.63 (67)	4,180 (18.6)	5,120 (22.8)	635 (2.8)	775 (3.4)
LP 3/8”	2.21 (56)	3,300 (14.7)	4,040 (18.0)	3,300 (14.7)	4,040 (18.0)
LP 1/2”	2.71 (69)	4,180 (18.6)	5,120 (22.8)	4,180 (18.6)	5,120 (22.8)

Table 22 — Hilti KCC-MD Short Plate and Long Plate factored tension resistance in the soffit of cracked sand-lightweight concrete over metal deck (B profile) [1,2,3,4,5,6,7,8]

Anchor	Nominal embed. in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5C	
		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
SP 3/8”	2.13 (54)	2,640 (11.7)	3,230 (14.4)	465 (2.1)	565 (2.5)
SP 1/2”	2.63 (67)	3,345 (14.9)	4,095 (18.2)	505 (2.2)	620 (2.8)
LP 3/8”	2.21 (56)	2,640 (11.7)	3,230 (14.4)	2,640 (11.7)	3,230 (14.4)
LP 1/2”	2.71 (69)	3,345 (14.9)	4,095 (18.2)	3,345 (14.9)	4,095 (18.2)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
4 Tabular values are for normal weight or sand-light weight concrete.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Compare tabular value to the insert steel strength values in Table 17 and threaded rod steel strength values in Table 27. The lesser of the values is to be used for the design.
7 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.19, Section 3.1.8.7 for additional information on seismic applications.
8 For Hilti KCC-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 20 for shear calculations.

Table 23 — Hilti KCC-MD Short Plate and Long Plate factored tension resistance in the soffit of uncracked sand-lightweight concrete over metal deck (W profile with 3-7/8" width) [1,2,3,4,5,6,7,8]

Anchor	Nominal embed. in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5B		Inclined per Figure 5D	
		Tension - N_r		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
SP 3/8"	2.13 (54)	3,300 (14.7)	4,040 (18.0)	1,685 (7.5)	2,065 (9.2)	-	-
SP 1/2"	2.63 (67)	4,180 (18.6)	5,120 (22.8)	1,935 (8.6)	2,370 (10.5)	-	-
LP 3/8"	2.21 (56)	3,300 (14.7)	4,040 (18.0)	4,470 (19.9)	5,475 (24.4)	3,300 (14.7)	4,040 (18.0)
LP 1/2"	2.71 (69)	4,180 (18.6)	5,120 (22.8)	5,990 (26.6)	7,340 (32.6)	4,180 (18.6)	5,120 (22.8)

Table 24 — Hilti KCC-MD Short Plate and Long Plate factored tension resistance in the soffit of cracked sand-lightweight concrete over metal deck (W profile with 3-7/8" width) [1,2,3,4,5,6,7,8]

Nominal anchor diameter in.	Nominal embed. in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5B		Inclined per Figure 5D	
		Tension - N_r		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
SP 3/8"	2.13 (54)	2,640 (11.7)	3,230 (14.4)	1,350 (6.0)	1,655 (7.4)	-	-
SP 1/2"	2.63 (67)	3,345 (14.9)	4,095 (18.2)	1,550 (6.9)	1,895 (8.4)	-	-
LP 3/8"	2.21 (56)	2,640 (11.7)	3,230 (14.4)	3,575 (15.9)	4,380 (19.5)	2,640 (11.7)	3,230 (14.4)
LP 1/2"	2.71 (69)	3,345 (14.9)	4,095 (18.2)	4,795 (21.3)	5,870 (26.1)	3,345 (14.9)	4,095 (18.2)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
4 Tabular values are for normal weight or sand-light weight concrete.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Compare tabular value to the insert steel strength values in Compare tabular value to the insert steel strength values in Table 17 and threaded rod steel strength values in Table 27. The lesser of the values is to be used for the design.
7 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.19, Section 3.1.8.7 for additional information on seismic applications.
8 For Hilti KCC-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 20 for shear calculations.

Table 25 — Hilti KCC-MD Short Plate and Long Plate factored tension resistance in the soffit of uncracked sand-lightweight concrete over metal deck (W profile with 4-1/2" width) [1,2,3,4,5,6,7,8]

Anchor	Nominal embed. in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5B		Inclined per Figure 5D	
		Tension - N_r		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
SP 3/8"	2.13 (54)	3,300 (14.7)	4,040 (18.0)	1,685 (7.5)	2,065 (9.2)	-	-
SP 1/2"	2.63 (67)	4,180 (18.6)	5,120 (22.8)	1,935 (8.6)	2,370 (10.5)	-	-
LP 3/8"	2.21 (56)	3,300 (14.7)	4,040 (18.0)	4,470 (19.9)	5,475 (24.4)	3,300 (14.7)	4,040 (18.0)
LP 1/2"	2.71 (69)	4,180 (18.6)	5,120 (22.8)	5,990 (26.6)	7,340 (32.6)	4,180 (18.6)	5,120 (22.8)

Table 26 — Hilti KCM-MD Short Plate and Long Plate factored tension resistance in the soffit of cracked sand-lightweight concrete over metal deck (W profile with 4-1/2" width) [1,2,3,4,5,6,7,8]

Anchor	Nominal embed. in. (mm)	Upper flute per Figure 5A		Lower flute per Figure 5B		Inclined per Figure 5D	
		Tension - N_r		Tension - N_r		Tension - N_r	
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
SP 3/8"	2.13 (54)	2,640 (11.7)	3,230 (14.4)	1,350 (6.0)	1,655 (7.4)	-	-
SP 1/2"	2.63 (67)	3,345 (14.9)	4,095 (18.2)	1,550 (6.9)	1,895 (8.4)	-	-
LP 3/8"	2.21 (56)	2,640 (11.7)	3,230 (14.4)	3,575 (15.9)	4,380 (19.5)	2,640 (11.7)	3,230 (14.4)
LP 1/2"	2.71 (69)	3,345 (14.9)	4,095 (18.2)	4,795 (21.3)	5,870 (26.1)	3,345 (14.9)	4,095 (18.2)

1 See Section 3.1.8.6 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
4 Tabular values are for normal weight or sand-light weight concrete.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Compare tabular value to the insert steel strength values in Table 17 and threaded rod steel strength values in Table 27. The lesser of the values is to be used for the design.
7 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.75. See PTG ED.19, Section 3.1.8.7 for additional information on seismic applications.
8 For Hilti KCC-MD anchors, calculation of static and seismic concrete strength in shear is not required. See Table 20 for shear calculations.

Table 27 — Design strength for steel failure of common threaded rods used with KCC-WF and KCC-MD cast-in anchor [1,2,3]

Nominal anchor diameter	Grade A36 threaded rod			ASTM A 193 B7 or ASTM F1554 Gr. 105 threaded rod			ASTM A 307, Grade A threaded rod		
	Tensile[4] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[5] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[6] $\phi V_{sar,eq,rod}$ lb (kN)	Tensile[4] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[5] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[6] $\phi V_{sar,eq,rod}$ lb (kN)	Tensile[4] $\phi N_{sar,rod}$ or $\phi N_{sar,eq,rod}$ lb (kN)	Shear[5] $\phi V_{sar,rod}$ lb (kN)	Seismic Shear[6] $\phi V_{sar,eq,rod}$ lb (kN)
1/4	1,260 (5.6)	705 (3.1)	495 (2.2)	2,720 (12.1)	1,520 (6.8)	1,064 (4.7)	1,290 (5.7)	725 (3.2)	508 (2.3)
3/8	3,075 (13.7)	1,720 (7.7)	1,205 (5.4)	6,630 (29.5)	3,705 (16.5)	2,594 (11.5)	3,160 (14.1)	1,780 (7.9)	1,246 (5.5)

1 See section 3.1.8.6 to convert design strength value to ASD value.
2 Hilti KCC-WF and KCC-MD anchors are to be considered brittle steel elements
3 See Section 3.1.8.7 for additional information on seismic applications.
4 Tensile $N_{sar} = \phi_s A_{se,N} R f_{ut}$ as noted in CSA A23.3 Annex D.
5 Shear values determined by static shear tests with $V_{sar} < \phi_s 0.60 A_{se,V} f_{ut} R$. as noted in CSA A23.3 Annex D.
6 Seismic shear values determined by seismic shear tests with $V_{sar,eq} < \phi_s 0.60 A_{se,V} f_{ut} R$. as noted in CSA A23.3 Annex D.

Table 28 — UL cUL LLC and FM approvals for KCC-WF, KCC-MD Short Plate and KCC-MD Long Plate Anchors [1,2]

Design information		WF and SP-MD 3/8"			WF and SP-MD 1/2"			LP 3/8"			LP 1/2"		
Nominal rod diameter (in.)	Metal deck soffit or Wood Form	UL max pipe size (in.)	Test load (lb)	FM max pipe size (in.)	UL max pipe size (in.)	Test load (lb)	FM max pipe size (in.)	UL max pipe size (in.)	Test load (lb)	FM max pipe size (in.)	UL max pipe size (in.)	Test load (lb)	FM max pipe size (in.)
3/8	Wood Form	4	1,500	4	-	-	-	4	1,500	4	-	-	-
	Upper flute	4	1,500	4	-	-	-	4	1,500	4	-	-	-
	Lower flute	4	1,500	4	-	-	-	4	1,500	4	-	-	-
1/2	Wood Form	-	-	-	8	4,050	8	-	-	-	8	4,050	8
	Upper flute	-	-	-	8	4,050	8	-	-	-	8	4,050	8
	Lower flute	-	-	-	8	4,050	8	-	-	-	8	4,050	8

1 UL LLC Listing based on successful completion of testing in accordance with UL 203.
2 FM Approval based on successful completion of testing in accordance with FM 1952.

INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed of downloaded online at www.hilti.com and www.hilti.ca. Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

ORDERING INFORMATION

KCC-WF and KCC-MD Short Plate and Long Plate cast-in anchors for use in metal deck[1]

Description	Anchor color [2]	Qty / box	Hole saw diameter
KCC-WF 3/8"	Dark Green	150	N/A
KCC-WF 1/2"	Dark Orange	100	N/A
KCC-MD SP 3/8"	Dark Green	75	11/16"
KCC-MD SP 1/2"	Dark Orange	45	13/16"
KCC-MD LP 3/8"	Dark Green	20	5/8"
KCC-MD LP 1/2"	Dark Orange	15	3/4"

1 All dimensions in inches
2 Identifies anchor size

SECTION 3

Bracing & Restraints

TOLCO Fig. 1CBS - Clevis Bolt Spacer

OPM

Size Range: Size 1" (25mm) thru 20" (500mm) clevis hanger

Material: Steel

Function: Used as a spacer at a seismic brace location to keep clevis hanger from collapsing during seismic event.

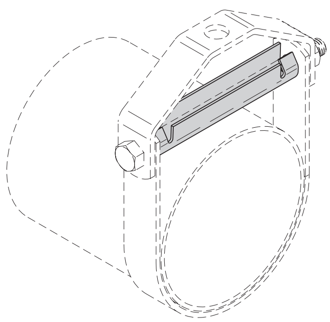
Approvals: Included in our Seismic Engineering Guidelines approved by the State of California Office of Statewide Health Planning and Development **(OSHPD)**. For additional load, spacing and placement information relating to OSHPD projects, please refer to our Seismic Engineering Guidelines OPM-0052-13, for 2½" - 8" (B3100) only

Installation Note: Fig. 1CBS fits easily over the cross bolt and attaches by pinching tabs down.

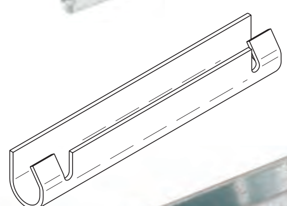
Finish: Pre-Galvanized. Contact customer service for alternative finishes and materials.

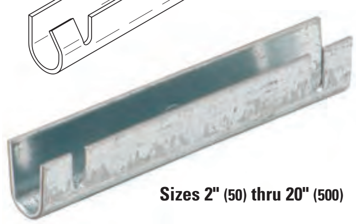
Order By: Figure number and finish.

Part No.	Pipe Size in.	(mm)	Approx. Wt./100 lbs.	(kg)
1CBS-1	1"	(25)	3.2	(1.4)
1CBS-1¼	1¼"	(32)	4.1	(1.8)
1CBS-1½	1½"	(40)	4.8	(2.2)
1CBS-2	2"	(50)	9.4	(4.2)
1CBS-2½	2½"	(65)	11.4	(5.2)
1CBS-3	3"	(75)	13.9	(6.8)
1CBS-3½	3½"	(90)	16.0	(7.2)
1CBS-4	4"	(100)	18.0	(8.1)
1CBS-5	5"	(125)	27.3	(12.4)
1CBS-6	6"	(150)	32.5	(14.7)
1CBS-8	8"	(200)	42.5	(19.2)
1CBS-10	10"	(250)	72.7	(32.9)
1CBS-12	12"	(300)	86.3	(39.1)
1CBS-14	14"	(350)	157.6	(71.5)
1CBS-16	16"	(400)	183.7	(83.3)
1CBS-18	18"	(450)	224.6	(101.9)
1CBS-20	20"	(500)	254.0	(115.2)



Sizes 1" (25) thru 1½" (40)





Sizes 2" (50) thru 20" (500)

TOLCO Fig. 25 - Surge Restrainer

Size Range: — One size fits ¾" (20mm) thru 2" (40mm) pipe.

Material: — Pre-Galvanized Steel

Function: — Designed to be used in conjunction with Fig. 200 band hangers to restrict the upward movement of piping as it occurs during sprinkler head activation or earthquake type activity. The surge restrainer is easily and efficiently installed by snapping into a locking position on the band hanger. This product is intended to satisfy the requirements as indicated in the National Fire Protection Association NFPA 13, 2016 edition, 9.2.3.4.4.1 and 9.2.3.4.4.4 Can be used to restrain either steel pipe or CPVC plastic Pipe.

Approvals: — Underwriters Laboratories Listed only when used with band hanger Fig. 200, in the USA **(UL)** and Canada **(cUL)**.

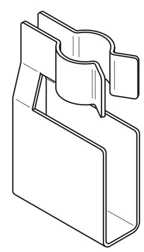
Finish: Pre-Galvanized

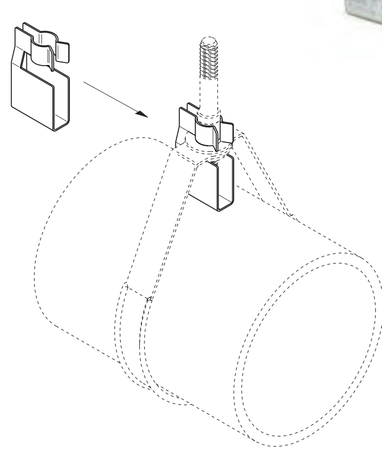
Order By: Figure number and band hanger, size from ¾" (20mm) thru 2" (40mm).

Patent #5,344,108

Part No.	Approx. Wt./100 lbs.	(kg)
25	4.8	(2.2)

c UL us LISTED



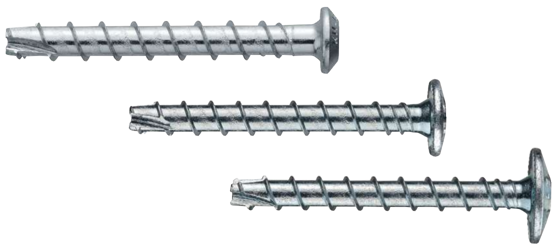


All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified.

3.3.6 KWIK HUS-EZ SCREW ANCHOR

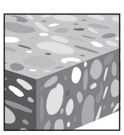
PRODUCT DESCRIPTION

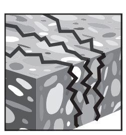
KWIK HUS EZ carbon steel anchors

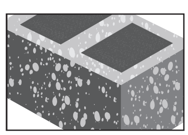
Anchor System	
	Carbon Steel KH-EZ C 1/4" and 3/8"
	Carbon Steel 1/4" KH-EZ P, PM, PL
	Carbon Steel KH EZ 1/4"-3/4"
	Carbon Steel KH-EZ CRC 3/8"-3/4"

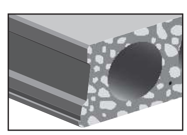
Features and Benefits

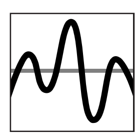
- OSHA Table 1926.1153 Table 1 complaint installation when installed with Hilti vacuum and DRS system or Hilti SafeSet™ hollow drill bit technology
- Easy installation using impact tool or torque wrench
- Product and length identification marks helps facilitate quality control after installation
- Through fixture installation improves productivity and more accurate installation.
- Thread design helps enable quality setting and exceptional load values in wide variety of base material strengths.
- 1/4" diameter available in hex head countersunk head and pan head styles.
- Anchor is fully removable.
- Anchor diameter is same as drill bit diameter. No special diameter bit required.
- Suitable for reduced edge distances and spacing.
- Corrosion resistant coating allows for use in outdoor moderate corrosive environments (KH-EZ CRC only).
- Installation process allows for adjustability.


Uncracked concrete


Cracked concrete


Grout-filled concrete masonry


Hollowcore concrete


Seismic Design Categories A-F

SafeSet™ System with Hollow Drill Bit

Profis Anchor design software

Approvals/Listings	
ICC-ES (International Code Council)	ESR-3027 in concrete per ACI 318 Ch. 17 / ACI 355.2/ ICC-ES AC193 ESR-3056 in grout-filled CMU per ICC-ES AC106
City of Los Angeles	City of Los Angeles 2020 LABC Supplement (within ESR-3027 and ESR-3056)
Florida Building Code	2020 FBC w/ HVHZ (within ESR-3027 and ESR-3056)
FM (Factory Mutual)	Pipe hanger components for automatic sprinkler systems for KH-EZ I and KH-EZ E
ANSI/MSS SP-58-2018	Anchors conform to ANSI/MSSP-58-2018. Contact Hilti for more information.

MATERIAL SPECIFICATIONS

Heat treated carbon steel with a minimum zinc coating of 0.0003 inch (8 µm) thick in accordance with DIN EN ISO 4042.
KH-EZ CRC has mechanically deposited zinc coating with a minimum thickness of 0.0021 inch (53 µm) in accordance with ASTM B695, Class 55.

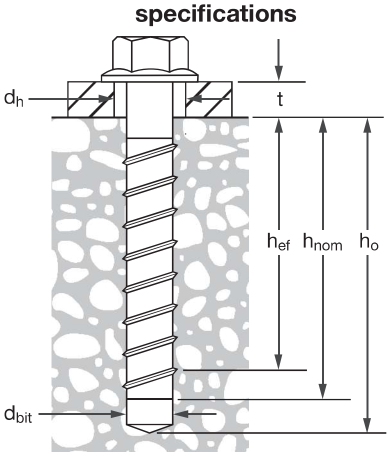
INSTALLATION PARAMETERS

Table 1 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC specifications

Setting information	Symbol	Units	Nominal anchor diameter													
			1/4		3/8				1/2			5/8			3/4	
Head style and coating			Hex, P, PM, PL, C head		Hex, C head		Hex, C head (Including CRC)		Hex head (Including CRC)			Hex head (Including CRC)			Hex head (Including CRC)	
Nominal bit diameter	d_{bit}	in.	1/4		3/8				1/2			5/8			3/4	
Minimum nominal embedment	h_{nom}	in.	1-5/8	2-1/2	1-5/8	2-1/8	2-1/2	3-1/4	2-1/4	3	4-1/4	3-1/4	4	5	4	6-1/4
Minimum effective embedment	h_{ef}	in.	1.18	1.92	1.11	1.54	1.86	2.50	1.50	2.16	3.22	2.39	3.03	3.88	2.92	4.84
Minimum hole depth	h_o	in.	2	2-7/8	1-7/8	2-3/8	2-3/4	3-1/2	2-5/8	3-3/8	4-5/8	3-5/8	4-3/8	5-3/8	4-3/8	6-5/8
Minimum fixture hole diameter	d_h	in.	3/8		1/2				5/8			3/4			7/8	
Anchor Length = h_{nom} + t	ℓ		See ordering information													
Installation torque concrete[1]	T_{inst}	ft-lb (Nm)	18 (24)		19 (26)	40 (54)			45 (61)			85 (115)			95[4] (129)	
Maximum impact wrench torque rating concrete[2]	$T_{impact,max}$	ft-lb (Nm)	157 (213)		157 (213)	450 (610)			137 (186)	450 (610)		590 (800)			590 (800)	
Installation torque masonry KH-EZ (P, PM, PL, C)[1]	T_{inst}	ft-lb (Nm)	21 (28)		22 (30)				34 (46)			38 (52)			70 (95)	
Installation torque masonry for KH-EZ CRC[1]	T_{inst}	ft-lb (Nm)					20 (27)		25 (34)			35 (48)			45 (61)	
Maximum impact wrench torque rating masonry for KH-EZ (P, PM, PL, C)[2,3]	$T_{impact,max}$	ft-lb (Nm)	114 (155)		114 (155)			332 (450)	332 (450)			332 (450)			332 (450)	
Maximum impact wrench torque rating masonry for KH-EZ CRC[2,3]	$T_{impact,max}$	ft-lb (Nm)					100 (136)		100 (136)			332 (450)			332 (450)	
Wrench size		in.	7/16		9/16				3/4			15/16			1-1/8	

1 T_{inst} is the maximum installation torque that may be applied with a torque wrench.
2 Because of variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over torquing can damage the base material, anchor and/or reduce its holding capacity.
3 For more information on KH-EZ installed in masonry, see ESR-3056 and Design Information for Masonry in this section.
4 Maximum installation torque in concrete for 3/4-in diameter KH-EZ CRC is 95 ft-lbs. (115 Nm).

Figure 1 — Hilti KH-EZ specifications



DESIGN INFORMATION IN CONCRETE PER ACI 318

ACI 318 Chapter 17 design

The load values contained in this section are Hilti Simplified Design Tables. The load tables in this section were developed using the Strength Design parameters and variables of ESR-3027 and the equations within ACI 318 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8 of the North American Product Technical Guide, Volume 2: Anchor Fastening Technical Guide, Edition 22 (PTG Ed. 21). Data tables from ESR-3027 are not contained in this section, but can be found at www.icc-es.org or at www.hilti.com.

Table 2 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC design Strength with concrete / pullout failure in uncracked concrete[1,2,3,4]

Nominal anchor diameter in. (mm)	Nominal Embed. Depth in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)
1/4 (6.4)	1-5/8 (41)	585 (2.6)	620 (2.8)	675 (3.0)	765 (3.4)	1,075 (4.8)	1,180 (5.2)	1,360 (6.0)	1,670 (7.4)
	2-1/2 (64)	1,525 (6.8)	1,670 (7.4)	1,930 (8.6)	2,365 (10.5)	2,235 (9.9)	2,450 (10.9)	2,825 (12.6)	3,460 (15.4)
3/8 (9.5)	1-5/8 (41)	910 (4.0)	1,000 (4.4)	1,155 (5.1)	1,415 (6.3)	980 (4.4)	1,075 (4.8)	1,245 (5.5)	1,520 (6.8)
	2-1/8 (54)	1,490 (6.6)	1,635 (7.3)	1,885 (8.4)	2,310 (10.3)	1,605 (7.1)	1,760 (7.8)	2,030 (9.0)	2,485 (11.1)
	2-1/2 (64)	1,980 (8.8)	2,165 (9.6)	2,505 (11.1)	3,065 (13.6)	2,130 (9.5)	2,335 (10.4)	2,695 (12.0)	3,300 (14.7)
	3-1/4 (83)	3,085 (13.7)	3,375 (15.0)	3,900 (17.3)	4,775 (21.2)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
1/2 (12.7)	2-1/4 (57)	1,645 (7.3)	1,800 (8.0)	2,080 (9.3)	2,550 (11.3)	1,770 (7.9)	1,940 (8.6)	2,240 (10.0)	2,745 (12.2)
	3 (76)	2,785 (12.4)	3,050 (13.6)	3,525 (15.7)	4,315 (19.2)	3,000 (13.3)	3,285 (14.6)	3,795 (16.9)	4,645 (20.7)
	4-1/4 (108)	5,070 (22.6)	5,555 (24.7)	6,415 (28.5)	7,855 (34.9)	10,920 (48.6)	11,965 (53.2)	13,815 (61.5)	16,920 (75.3)
5/8 (15.9)	3-1/4 (83)	3,240 (14.4)	3,550 (15.8)	4,100 (18.2)	5,025 (22.4)	3,490 (15.5)	3,825 (17.0)	4,415 (19.6)	5,410 (24.1)
	4 (102)	4,630 (20.6)	5,070 (22.6)	5,855 (26.0)	7,170 (31.9)	9,970 (44.3)	10,920 (48.6)	12,610 (56.1)	15,445 (68.7)
	5 (127)	6,705 (29.8)	7,345 (32.7)	8,485 (37.7)	10,390 (46.2)	14,445 (64.3)	15,825 (70.4)	18,270 (81.3)	22,380 (99.6)
3/4 (19.1)	4 (102)	4,380 (19.5)	4,795 (21.3)	5,540 (24.6)	6,785 (30.2)	9,430 (41.9)	10,330 (45.9)	11,930 (53.1)	14,610 (65.0)
	6-1/4 (159)	9,345 (41.6)	10,235 (45.5)	11,820 (52.6)	14,475 (64.4)	20,125 (89.5)	22,045 (98.1)	25,455 (113.2)	31,175 (138.7)

Table 3 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC design Strength with concrete / pullout failure in cracked concrete[1,2,3,4,5]

Nominal anchor diameter in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)
1/4 (6.4)	1-5/8 (41)	300 (1.3)	315 (1.4)	345 (1.5)	390 (1.7)	765 (3.4)	835 (3.7)	965 (4.3)	1,180 (5.2)
	2-1/2 (64)	760 (3.4)	830 (3.7)	960 (4.3)	1,175 (5.2)	1,585 (7.1)	1,735 (7.7)	2,000 (8.9)	2,450 (10.9)
3/8 (9.5)	1-5/8 (41)	475 (2.1)	520 (2.3)	600 (2.7)	730 (3.2)	695 (3.1)	760 (3.4)	880 (3.9)	1,080 (4.8)
	2-1/8 (54)	1,055 (4.7)	1,155 (5.1)	1,335 (5.9)	1,635 (7.3)	1,135 (5.0)	1,245 (5.5)	1,440 (6.4)	1,760 (7.8)
	2-1/2 (64)	1,400 (6.2)	1,535 (6.8)	1,775 (7.9)	2,170 (9.7)	1,510 (6.7)	1,655 (7.4)	1,910 (8.5)	2,340 (10.4)
	3-1/4 (83)	2,185 (9.7)	2,390 (10.6)	2,765 (12.3)	3,385 (15.1)	4,705 (20.9)	5,155 (22.9)	5,950 (26.5)	7,285 (32.4)
1/2 (12.7)	2-1/4 (57)	1,035 (4.6)	1,135 (5.0)	1,310 (5.8)	1,605 (7.1)	1,115 (5.0)	1,220 (5.4)	1,410 (6.3)	1,725 (7.7)
	3 (76)	1,755 (7.8)	1,920 (8.5)	2,220 (9.9)	2,715 (12.1)	1,890 (8.4)	2,070 (9.2)	2,390 (10.6)	2,925 (13.0)
	4-1/4 (108)	3,190 (14.2)	3,495 (15.5)	4,040 (18.0)	4,945 (22.0)	6,875 (30.6)	7,530 (33.5)	8,695 (38.7)	10,650 (47.4)
5/8 (15.9)	3-1/4 (83)	2,040 (9.1)	2,235 (9.9)	2,580 (11.5)	3,165 (14.1)	2,200 (9.8)	2,410 (10.7)	2,780 (12.4)	3,405 (15.1)
	4 (102)	3,140 (14.0)	3,510 (15.6)	3,845 (17.1)	4,515 (20.1)	6,760 (30.1)	7,560 (33.6)	8,280 (36.8)	9,725 (43.3)
	5 (127)	4,225 (18.8)	4,625 (20.6)	5,340 (23.8)	6,540 (29.1)	9,095 (40.5)	9,965 (44.3)	11,505 (51.2)	14,090 (62.7)
3/4 (19.1)	4 (102)	2,755 (12.3)	3,020 (13.4)	3,485 (15.5)	4,270 (19.0)	5,940 (26.4)	6,505 (28.9)	7,510 (33.4)	9,200 (40.9)
	6-1/4 (159)	5,885 (26.2)	6,445 (28.7)	7,440 (33.1)	9,115 (40.5)	12,670 (56.4)	13,880 (61.7)	16,030 (71.3)	19,630 (87.3)

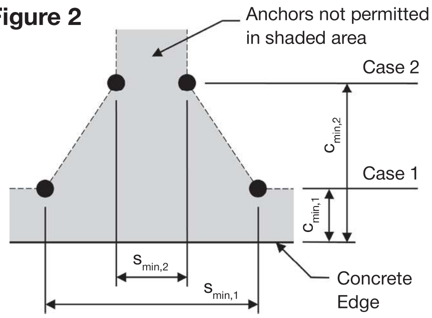
1 See PTG Ed. 21 Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in Tables 6 through 15 as necessary. Compare to the steel values in Table 4. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λa as follows: For sand-lightweight, λa = 0.68. For all-lightweight, λa = 0.60.
5 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-in diameter by 1-5/8-in nominal embedment depth - $a_{N,seis}$ = 0.60
All other sizes - $a_{N,seis}$ = 0.75
No reduction needed for seismic shear. See PTG Ed. 21 Section 3.1.8 for additional information on seismic applications.

Table 4 — Steel design strength for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC anchors[1,2]

Anchor diameter in. (mm)	Nominal embedment depth in. (mm)			Tensile [3] ϕN_{sa} lb (kN)	Shear [4] ϕV_{sa} lb (kN)	Seismic shear [5] $\phi V_{sa,eq}$ lb (kN)
1/4 (6.4)	1-5/8 (41)	2-1/2 (64)		3,945 (17.5)	930 (4.1)	835 (3.7)
3/8 (9.5)	1-5/8 (41)	2-1/8 (54)		5,980 (26.6)	2,200 (9.8)	2,200 (9.8)
	2-1/2 (64)	3-1/4 (83)		6,720 (29.9)	3,110 (13.8)	1,865 (8.3)
1/2 (12.7)	2-1/4 (57)	3 (76)	4-1/4 (108)	11,780 (52.4)	5,545 (24.7)	3,330 (14.8)
5/8 (15.9)	3-1/4 (83)	4 (102)	5 (127)	15,735 (70.0)	6,735 (30.0)	4,040 (18.0)
3/4 (19.1)	4 (102)	6-1/4 (159)		20,810 (92.6)	9,995 (44.5)	6,935 (30.8)

1 See PTG Ed. 21 Section 3.1.8 to convert design strength value to ASD value.
2 Hilti KH-EZ anchors are to be considered brittle steel elements.
3 Tensile $\phi N_{sa} = \phi\ A_{se,N}\ f_{uta}$ as noted in ACI 318 Chapter 17.
4 Shear values determined by static shear tests with ϕVsa < ϕ 0.60 Ase,V futa as noted in ACI 318 Chapter 17.
5 Seismic shear values determined by seismic shear tests with $\phi V_{sa} \le \phi\ 0.60\ A_{se,V}\ f_{uta}$ as noted in ACI 318 Chapter 17. See PTG Ed. 21 Section 3.1.8 for additional information on seismic applications.

Figure 2



For a specific edge distance, the permitted spacing is calculated as follows:

$$s \ge s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})}\ (c - c_{min,2})$$

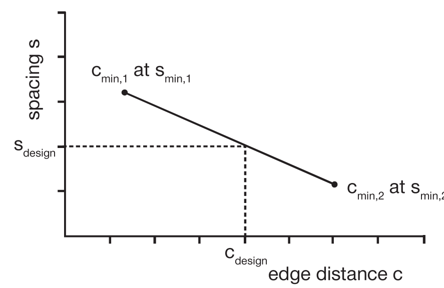


Table 5 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC specifications[1]

Setting information		Symbol	Units	Nominal anchor diameter												
				1/4		3/8				1/2			5/8		3/4	
Effective minimum embedment		h_{ef}	in.	1.18	1.92	1.11	1.54	1.86	2.50	1.50	2.16	3.22	2.39	3.03	3.88	2.92	4.84
Minimum member thickness		h_{min}	in.	3-1/4	4-1/8	3-1/4	3-2/3	4	4-7/8	4-1/2	4-3/4	6-3/4	5	6	7	6	8-1/8
Case 1		$c_{min,1}$	in.	1.50						1.75							
		for $s_{min,1} \ge$	in.	3									4				
Case 2		$c_{min,2}$	in.	2	2.78	2.63	2.75	2.92	3.75	1.75			3.63	4.57	5.81	4.41	7.28
		for $s_{min,2} \ge$	in.	1.50		2.25				3							

1 Linear interpolation is permitted to establish an edge distance and spacing combination between Case 1 and Case 2. Linear interpolation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$ will determine the permissible spacings.

Table 6 — Load adjustment factors for 1/4-in. diameter Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL and KH-EZ C in uncracked concrete[1,2]

1/4-in. KH-EZ uncracked concrete			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear ⊥ toward edge f_{RV}		Edge distance in shear II to and away from edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Embedment h_{nom}	in.	(mm)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-1/2	(38)	0.71	0.63	0.78	0.65	0.59	0.56	0.40	0.21	0.78	0.42	n/a	n/a
	2	(51)	0.78	0.67	1.00	0.77	0.62	0.58	0.61	0.33	1.00	0.65	n/a	n/a
	2-1/2	(64)	0.85	0.72		0.90	0.65	0.60	0.86	0.46		0.90	n/a	n/a
	3	(76)	0.92	0.76		1.00	0.68	0.62	1.00	0.60		1.00	n/a	n/a
	3-1/4	(83)	0.96	0.78			0.70	0.63		0.68			0.88	n/a
	3-1/2	(89)	0.99	0.80			0.71	0.64		0.76			0.92	n/a
	4	(102)	1.00	0.85			0.74	0.66		0.92			0.98	n/a
	4-1/8	(105)		0.86			0.75	0.66		0.97			1.00	0.81
	4-1/2	(114)		0.89			0.77	0.68		1.00				0.84
	5	(127)		0.93			0.80	0.70						0.89
	5-1/2	(140)		0.98			0.83	0.72						0.93
	6	(152)		1.00			0.86	0.74						0.97
	7	(178)					0.92	0.78						1.00
	8	(203)					0.98	0.82						
	9	(229)					1.00	0.86						
	10	(254)						0.89						
	11	(279)						0.93						
	12	(305)						0.97						
	14	(356)						1.00						

Table 7 — Load adjustment factors for 1/4-in. diameter Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL and KH-EZ C in cracked concrete[1,2]

1/4-in. KH-EZ cracked concrete			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear ⊥ toward edge f_{RV}		Edge distance in shear II to and away from edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Embedment h_{nom}	in.	(mm)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/2 (64)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-1/2	(38)	0.71	0.63	0.88	0.65	0.59	0.56	0.40	0.21	0.80	0.43	n/a	n/a
	2	(51)	0.78	0.67	1.00	0.77	0.62	0.58	0.62	0.33	1.00	0.66	n/a	n/a
	2-1/2	(64)	0.85	0.72		0.90	0.65	0.60	0.87	0.46		0.90	n/a	n/a
	3	(76)	0.92	0.76		1.00	0.68	0.62	1.00	0.60		1.00	n/a	n/a
	3-1/4	(83)	0.96	0.78			0.70	0.63		0.68			0.89	n/a
	3-1/2	(89)	0.99	0.80			0.71	0.64		0.76			0.92	n/a
	4	(102)	1.00	0.85			0.74	0.66		0.93			0.98	n/a
	4-1/8	(105)		0.86			0.75	0.66		0.97			1.00	0.81
	4-1/2	(114)		0.89			0.77	0.68		1.00				0.85
	5	(127)		0.93			0.80	0.70						0.89
	5-1/2	(140)		0.98			0.83	0.72						0.93
	6	(152)		1.00			0.86	0.74						0.98
	7	(178)					0.92	0.78						1.00
	8	(203)					0.98	0.82						
	9	(229)					1.00	0.86						
	10	(254)						0.90						
	11	(279)						0.94						
	12	(305)						0.98						
	14	(356)						1.00						

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering software or perform anchor calculation using design equations from ACI 318 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

Table 8 — Load Adjustment Factors for 3/8-in. diameter Hilti KH-EZ, KH-EZ C and KH-EZ CRC in uncracked [1,2]

3/8-in. KH-EZ uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear [3] f_{AV}				Edge distance in shear: ⊥ toward edge f_{RV}				Edge distance in shear: II to and away from edge f_{RV}				Conc. thickness factor in shear [4] f_{HV}			
Embedment h_{nom}	in.	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4
	(mm)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm): 1-1/2	(38)	n/a	n/a	n/a	n/a	0.58	0.62	0.63	0.57	n/a	n/a	n/a	n/a	0.49	0.32	0.25	0.08	0.58	0.62	0.50	0.17	n/a	n/a	n/a	n/a
2	(51)	n/a	n/a	n/a	n/a	0.76	0.75	0.75	0.66	n/a	n/a	n/a	n/a	0.75	0.49	0.38	0.13	0.76	0.75	0.75	0.26	n/a	n/a	n/a	n/a
2-1/4	(57)	0.84	0.74	0.70	0.65	0.86	0.82	0.81	0.70	0.65	0.62	0.60	0.55	0.90	0.59	0.46	0.16	0.90	0.82	0.81	0.31	n/a	n/a	n/a	n/a
2-1/2	(64)	0.88	0.77	0.72	0.67	0.95	0.91	0.88	0.75	0.67	0.63	0.61	0.55	1.00	0.69	0.54	0.18	1.00	0.91	0.88	0.37	n/a	n/a	n/a	n/a
3	(76)	0.95	0.82	0.77	0.70	1.00	1.00	1.00	0.85	0.71	0.66	0.63	0.56		0.90	0.71	0.24		1.00	1.00	0.48	n/a	n/a	n/a	n/a
3-1/4	(83)	0.99	0.85	0.79	0.72				0.90	0.72	0.67	0.64	0.57		1.00	0.80	0.27				0.54	0.95	n/a	n/a	n/a
3-1/2	(89)	1.00	0.88	0.81	0.73				0.95	0.74	0.68	0.65	0.58			0.89	0.30				0.61	0.98	n/a	n/a	n/a
4	(102)		0.93	0.86	0.77				1.00	0.78	0.71	0.68	0.59			1.00	0.37				0.74	1.00	0.91	0.84	n/a
4-1/2	(114)		0.99	0.90	0.80					0.81	0.73	0.70	0.60				0.44				0.88			0.89	n/a
4-3/4	(121)		1.00	0.93	0.82					0.83	0.75	0.71	0.60				0.48				0.96			0.91	0.639
5	(127)			0.95	0.83					0.84	0.76	0.72	0.61				0.52				1.00			0.94	0.655
6	(152)			1.00	0.90					0.91	0.81	0.76	0.63				0.68							1.00	0.718
7	(178)				0.97					0.98	0.86	0.81	0.65				0.86								0.775
8	(203)				1.00					1.00	0.91	0.85	0.67				1.00								0.829
9	(229)										0.97	0.90	0.69												0.879
10	(254)										1.00	0.94	0.71												0.927
11	(279)											0.98	0.74												0.972
12	(305)											1.00	0.76												1.000
14	(356)												0.80												
16	(406)												0.84												
18	(457)												0.89												
20	(508)												0.93												
24	(610)												1.000												

Table 9 — Load Adjustment Factors for 3/8-in. diameter Hilti KH-EZ, KH-EZ C and KH-EZ CRC in cracked [1,2]

3/8-in. KH-EZ cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear [3] f_{AV}				Edge distance in shear: ⊥ toward edge f_{RV}				Edge distance in shear: II to and away from edge f_{RV}				Conc. thickness factor in shear [4] f_{HV}			
Embedment h_{nom}	in.	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4
	(mm)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm): 1-1/2	(38)	n/a	n/a	n/a	n/a	0.92	0.74	0.66	0.57	n/a	n/a	n/a	n/a	0.49	0.32	0.25	0.09	0.92	0.64	0.50	0.17	n/a	n/a	n/a	n/a
2	(51)	n/a	n/a	n/a	n/a	1.00	0.90	0.79	0.66	n/a	n/a	n/a	n/a	0.76	0.50	0.39	0.13	1.00	0.90	0.77	0.26	n/a	n/a	n/a	n/a
2-1/4	(57)	0.84	0.74	0.70	0.65	1.00	0.98	0.85	0.70	0.66	0.62	0.60	0.55	0.90	0.59	0.46	0.16	1.00	0.98	0.85	0.31	n/a	n/a	n/a	n/a
2-1/2	(64)	0.88	0.77	0.72	0.67	1.00	1.00	0.92	0.75	0.67	0.63	0.61	0.55	1.00	0.69	0.54	0.18	1.00	1.00	0.92	0.37	n/a	n/a	n/a	n/a
3	(76)	0.95	0.82	0.77	0.70	1.00		1.00	0.85	0.71	0.66	0.63	0.56	1.00	0.91	0.71	0.24	1.00	1.00	1.00	0.48	n/a	n/a	n/a	n/a
3-1/4	(83)	0.99	0.85	0.79	0.72				0.90	0.73	0.67	0.64	0.57		1.00	0.80	0.27				0.55	0.95	n/a	n/a	n/a
3-1/2	(89)	1.00	0.88	0.81	0.73				0.95	0.74	0.68	0.65	0.58			0.90	0.31				0.61	0.98	n/a	n/a	n/a
4	(102)		0.93	0.86	0.77				1.00	0.78	0.71	0.68	0.59			1.00	0.37				0.75	1.00	0.91	0.84	n/a
4-1/2	(114)		0.99	0.90	0.80					0.81	0.73	0.70	0.60				0.44				0.89		0.97	0.89	n/a
4-3/4	(121)		1.00	0.93	0.82					0.83	0.75	0.71	0.60				0.48				0.97		1.00	0.92	0.64
5	(127)			0.95	0.83					0.85	0.76	0.72	0.61				0.52				1.00			0.94	0.66
6	(152)			1.00	0.90					0.92	0.81	0.77	0.63				0.69							1.00	0.72
7	(178)				0.97					0.98	0.87	0.81	0.65				0.86								0.78
8	(203)				1.00					1.00	0.92	0.85	0.67				1.00								0.83
9	(229)										0.97	0.90	0.69												0.88
10	(254)										1.00	0.94	0.72												0.93
11	(279)											0.99	0.74												0.97
12	(305)											1.00	0.76												1.00
14	(356)												0.80												
16	(406)												0.85												
18	(457)												0.89												
20	(508)												0.93												
24	(610)												1.00												

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering software or perform anchor calculation using design equations from ACI 318-14 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

Table 10 — Load adjustment factors for 1/2-in. diameter Hilti KH-EZ and KH-EZ CRC in uncracked concrete[1,2]

1/2-in. KH-EZ uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ toward edge f_{RV}			Edge distance in shear: II to and away from edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Embedment h_{nom}	in.	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4
	(mm)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)																			
1-3/4	(44)	n/a	n/a	n/a	0.68	0.57	0.51	n/a	n/a	n/a	0.40	0.25	0.07	0.68	0.50	0.15	n/a	n/a	n/a
2	(51)	n/a	n/a	n/a	0.75	0.62	0.54	n/a	n/a	n/a	0.48	0.31	0.09	0.75	0.61	0.18	n/a	n/a	n/a
2-1/2	(64)	n/a	n/a	n/a	0.91	0.71	0.60	n/a	n/a	n/a	0.68	0.43	0.13	0.91	0.71	0.25	n/a	n/a	n/a
3	(76)	0.83	0.73	0.66	1.00	0.81	0.66	0.65	0.61	0.55	0.89	0.56	0.17	1.00	0.81	0.33	n/a	n/a	n/a
3-1/2	(89)	0.88	0.77	0.68		0.93	0.73	0.68	0.63	0.56	1.00	0.71	0.21		0.93	0.42	n/a	n/a	n/a
4	(102)	0.94	0.81	0.71		1.00	0.80	0.71	0.65	0.57		0.87	0.26		1.00	0.52	n/a	n/a	n/a
4-1/2	(114)	0.99	0.85	0.73			0.87	0.73	0.67	0.58		1.00	0.31			0.62	0.96	n/a	n/a
4-3/4	(121)	1.00	0.87	0.75			0.91	0.74	0.68	0.58			0.33			0.67	0.99	0.85	n/a
5	(127)		0.89	0.76			0.95	0.76	0.69	0.58			0.36			0.72	1.00	0.87	n/a
6	(152)		0.96	0.81			1.00	0.81	0.73	0.60			0.47			0.95		0.95	n/a
6-3/4	(171)		1.00	0.85				0.85	0.76	0.61			0.57			1.00		1.00	0.68
7	(178)			0.86				0.86	0.77	0.62			0.60						0.69
8	(203)			0.91				0.91	0.80	0.64			0.73						0.73
9	(229)			0.97				0.96	0.84	0.65			0.87						0.78
10	(254)			1.00				1.00	0.88	0.67			1.00						0.82
11	(279)								0.92	0.69									0.86
12	(305)								0.95	0.70									0.90
14	(356)								1.00	0.74									0.97
16	(406)									0.77									1.00
18	(457)									0.80									
20	(508)									0.84									
> 24	(610)									0.91									

Table 11 — Load adjustment factors for 1/2-in. diameter Hilti KH-EZ and KH-EZ CRC in cracked concrete[1,2]

3.3.6

1/2-in. KH-EZ cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ toward edge f_{RV}			Edge distance in shear: II to and away from edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Embedment h_{nom}	in.	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4	2-1/4	3	4-1/4
	(mm)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)	(57)	(76)	(108)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)																			
1-3/4	(44)	n/a	n/a	n/a	0.82	0.66	0.55	n/a	n/a	n/a	0.45	0.28	0.08	0.82	0.57	0.17	n/a	n/a	n/a
2	(51)	n/a	n/a	n/a	0.90	0.72	0.58	n/a	n/a	n/a	0.55	0.35	0.10	0.90	0.70	0.21	n/a	n/a	n/a
2-1/2	(64)	n/a	n/a	n/a	1.00	0.83	0.65	n/a	n/a	n/a	0.77	0.49	0.14	1.00	0.83	0.29	n/a	n/a	n/a
3	(76)	0.83	0.73	0.66	1.00	0.94	0.72	0.67	0.62	0.56	1.00	0.64	0.19	1.00	0.94	0.38	n/a	n/a	n/a
3-1/2	(89)	0.88	0.77	0.68		1.00	0.79	0.70	0.64	0.56		0.80	0.24		1.00	0.48	n/a	n/a	n/a
4	(102)	0.94	0.81	0.71		1.00	0.87	0.72	0.66	0.57		0.98	0.29		1.00	0.59	n/a	n/a	n/a
4-1/2	(114)	0.99	0.85	0.73			0.95	0.75	0.69	0.58		1.00	0.35			0.70	1.00	n/a	n/a
4-3/4	(121)	1.00	0.87	0.75			0.99	0.77	0.70	0.59			0.38			0.76		0.88	n/a
5	(127)		0.89	0.76			1.00	0.78	0.71	0.59			0.41			0.82		0.91	n/a
6	(152)		0.96	0.81			1.00	0.84	0.75	0.61			0.54			1.00		0.99	n/a
6-3/4	(171)		1.00	0.85				0.88	0.78	0.62			0.64					1.00	0.70
7	(178)			0.86				0.89	0.79	0.63			0.68						0.72
8	(203)			0.91				0.95	0.83	0.65			0.83						0.77
9	(229)			0.97				1.00	0.87	0.67			0.99						0.81
10	(254)			1.00					0.91	0.68			1.00						0.86
11	(279)								0.95	0.70									0.90
12	(305)								0.99	0.72									0.94
14	(356)								1.00	0.76									1.00
16	(406)									0.79									
18	(457)									0.83									
20	(508)									0.87									
> 24	(610)									0.94									

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering software or perform anchor calculation using design equations from ACI 318 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

Table 12 — Load adjustment factors for 5/8-in. diameter Hilti KH-EZ and KH-EZ CRC in uncracked concrete[1,2]

5/8-in. KH-EZ uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ toward edge f_{RV}			Edge distance in shear: II to and away from edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Embedment h_{nom}	in.	3-1/4	4	5	3-1/4	4	5	3-1/4	4	5	3-1/4	4	5	3-1/4	4	5	3-1/4	4	5
	(mm)	(83)	(102)	(127)	(83)	(102)	(127)	(83)	(102)	(127)	(83)	(102)	(127)	(83)	(102)	(127)	(83)	(102)	(127)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)																			
1-3/4	(44)	n/a	n/a	n/a	0.622	0.562	0.514	n/a	n/a	n/a	0.235	0.086	0.063	0.470	0.173	0.125	n/a	n/a	n/a
2	(51)	n/a	n/a	n/a	0.667	0.596	0.540	n/a	n/a	n/a	0.287	0.106	0.076	0.574	0.211	0.153	n/a	n/a	n/a
2-1/2	(64)	n/a	n/a	n/a	0.762	0.667	0.592	n/a	n/a	n/a	0.401	0.147	0.107	0.762	0.295	0.214	n/a	n/a	n/a
3	(76)	0.709	0.665	0.629	0.863	0.741	0.648	0.609	0.556	0.545	0.528	0.194	0.141	0.863	0.388	0.281	n/a	n/a	n/a
3-1/2	(89)	0.744	0.693	0.650	0.969	0.819	0.705	0.627	0.565	0.553	0.665	0.244	0.177	0.969	0.488	0.354	n/a	n/a	n/a
4	(102)	0.779	0.720	0.672	1.000	0.901	0.764	0.645	0.574	0.560	0.812	0.298	0.216	1.000	0.597	0.433	n/a	n/a	n/a
4-1/2	(114)	0.814	0.748	0.693		0.987	0.826	0.663	0.584	0.568	0.969	0.356	0.258		0.712	0.516	n/a	n/a	n/a
5	(127)	0.849	0.775	0.715		1.000	0.890	0.681	0.593	0.575	1.000	0.417	0.302		0.834	0.605	0.852	n/a	n/a
5-1/2	(140)	0.884	0.803	0.736			0.956	0.700	0.602	0.583		0.481	0.349		0.962	0.698	0.893	n/a	n/a
6	(152)	0.918	0.830	0.758			1.000	0.718	0.612	0.590		0.548	0.398		1.000	0.795	0.933	0.668	n/a
7	(178)	0.988	0.885	0.801				0.754	0.630	0.605		0.691	0.501			1.000	1.000	0.722	0.648
8	(203)	1.000	0.940	0.844				0.790	0.649	0.620		0.844	0.612					0.772	0.693
9	(229)		0.995	0.887				0.827	0.667	0.635		1.000	0.730					0.818	0.735
10	(254)		1.000	0.930				0.863	0.686	0.650			0.855					0.863	0.775
11	(279)			0.973				0.899	0.705	0.665			0.987					0.905	0.813
12	(305)			1.000				0.935	0.723	0.680			1.000					0.945	0.849
14	(356)							1.000	0.760	0.710								1.000	0.917
16	(406)								0.798	0.740									0.980
18	(457)								0.835	0.770									1.000
20	(508)								0.872	0.800									
24	(610)								0.947	0.860									
> 30	(762)								1.000	0.951									

Table 13 — Load adjustment factors for 5/8-in. diameter Hilti KH-EZ and KH-EZ CRC in cracked concrete[1,2]

5/8-in. KH-EZ cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear[3] f_{AV}			Edge distance in shear: ⊥ toward edge f_{RV}			Edge distance in shear: II to and away from edge f_{RV}			Conc. thickness factor in shear[4] f_{HV}		
Embedment h_{nom}	in.	3-1/4	4	5	3-1/4	4	5	3-1/4	4	5	3-1/4	4	5	3-1/4	4	5	3-1/4	4	5
	(mm)	(83)	(102)	(127)	(83)	(102)	(127)	(83)	(102)	(127)	(83)	(102)	(127)	(83)	(102)	(127)	(83)	(102)	(127)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)																			
1-3/4	(44)	n/a	n/a	n/a	0.630	0.565	0.514	n/a	n/a	n/a	0.267	0.098	0.071	0.533	0.196	0.142	n/a	n/a	n/a
2	(51)	n/a	n/a	n/a	0.676	0.599	0.540	n/a	n/a	n/a	0.326	0.120	0.087	0.652	0.239	0.174	n/a	n/a	n/a
2-1/2	(64)	n/a	n/a	n/a	0.772	0.670	0.592	n/a	n/a	n/a	0.455	0.167	0.121	0.772	0.335	0.243	n/a	n/a	n/a
3	(76)	0.709	0.665	0.629	0.873	0.745	0.648	0.618	0.561	0.549	0.599	0.220	0.159	0.873	0.440	0.319	n/a	n/a	n/a
3-1/2	(89)	0.744	0.693	0.650	0.981	0.824	0.705	0.638	0.571	0.557	0.754	0.277	0.201	0.981	0.554	0.402	n/a	n/a	n/a
4	(102)	0.779	0.720	0.672	1.000	0.906	0.764	0.658	0.581	0.565	0.922	0.339	0.245	1.000	0.677	0.491	n/a	n/a	n/a
4-1/2	(114)	0.814	0.748	0.693		0.992	0.826	0.678	0.591	0.574	1.000	0.404	0.293		0.808	0.586	n/a	n/a	n/a
5	(127)	0.849	0.775	0.715		1.000	0.890	0.697	0.601	0.582	1.000	0.473	0.343		0.946	0.686	0.888	n/a	n/a
5-1/2	(140)	0.884	0.803	0.736			0.956	0.717	0.611	0.590		0.546	0.396		1.000	0.792	0.932	n/a	n/a
6	(152)	0.918	0.830	0.758			1.000	0.737	0.621	0.598		0.622	0.451			0.902	0.973	0.697	n/a
7	(178)	0.988	0.885	0.801				0.776	0.642	0.614		0.784	0.568			1.000	1.000	0.753	0.676
8	(203)	1.000	0.940	0.844				0.816	0.662	0.631		0.958	0.694					0.805	0.723
9	(229)		0.995	0.887				0.855	0.682	0.647		1.000	0.828					0.854	0.767
10	(254)		1.000	0.930				0.895	0.702	0.663			0.970					0.900	0.808
11	(279)			0.973				0.934	0.723	0.680			1.000					0.944	0.848
12	(305)			1.000				0.974	0.743	0.696								0.986	0.885
14	(356)							1.000	0.783	0.729								1.000	0.956
16	(406)								0.824	0.761									1.000
18	(457)								0.864	0.794									
20	(508)								0.905	0.827									
24	(610)								0.986	0.892									
> 30	(762)								1.000	0.990									

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering software or perform anchor calculation using design equations from ACI 318 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

Table 14 — Load adjustment factors for 3/4-in. diameter Hilti KH-EZ and KH-EZ CRC in uncracked concrete[1,2]

3/4-in. KH-EZ uncracked concrete		Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear ⊥ toward edge f_{RV}		Edge distance in shear II to and away from edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Embedment h_{nom}	in. (mm)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm): 1-3/4	(44)	n/a	n/a	0.57	0.48	n/a	n/a	0.10	0.05	0.19	0.10	n/a	n/a
2	(51)	n/a	n/a	0.61	0.50	n/a	n/a	0.12	0.06	0.23	0.12	n/a	n/a
2-1/2	(64)	n/a	n/a	0.68	0.54	n/a	n/a	0.16	0.08	0.33	0.17	n/a	n/a
3	(76)	0.67	0.60	0.76	0.58	0.56	0.54	0.21	0.11	0.43	0.22	n/a	n/a
3-1/2	(89)	0.70	0.62	0.84	0.62	0.57	0.55	0.27	0.14	0.54	0.28	n/a	n/a
4	(102)	0.73	0.64	0.93	0.67	0.58	0.55	0.33	0.17	0.66	0.34	n/a	n/a
4-1/2	(114)	0.76	0.65	1.00	0.72	0.59	0.56	0.39	0.20	0.79	0.41	n/a	n/a
5	(127)	0.79	0.67		0.76	0.60	0.56	0.46	0.24	0.92	0.48	n/a	n/a
5-1/2	(140)	0.81	0.69		0.81	0.61	0.57	0.53	0.28	1.00	0.55	n/a	n/a
6	(152)	0.84	0.71		0.86	0.62	0.58	0.61	0.31		0.63	0.69	n/a
7	(178)	0.90	0.74		0.97	0.64	0.59	0.77	0.40		0.79	0.75	n/a
8	(203)	0.96	0.78		1.00	0.66	0.60	0.94	0.48		0.97	0.80	n/a
8-1/8	(206)	0.96	0.78			0.66	0.60	0.96	0.50		0.99	0.80	0.65
9	(229)	1.00	0.81			0.68	0.62	1.00	0.58		1.00	0.85	0.68
10	(254)		0.84			0.70	0.63		0.68			0.89	0.72
11	(279)		0.88			0.72	0.64		0.78			0.94	0.75
12	(305)		0.91			0.74	0.65		0.89			0.98	0.79
14	(356)		0.98			0.78	0.68		1.00			1.00	0.85
16	(406)		1.00			0.82	0.71						0.91
18	(457)					0.86	0.73						0.96
20	(508)					0.90	0.76						1.00
24	(610)					0.98	0.81						
30	(762)					1.00	0.89						
> 36	(914)						0.96						

3.3.6

Table 15 — Load adjustment factors for 3/4-in. diameter Hilti KH-EZ and KH-EZ CRC in cracked concrete[1,2]

3/4-in. KH-EZ cracked concrete		Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear ⊥ toward edge f_{RV}		Edge distance in shear II to and away from edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Embedment h_{nom}	in. (mm)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)	4 (102)	6-1/4 (159)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm): 1-3/4	(44)	n/a	n/a	0.57	0.48	n/a	n/a	0.11	0.06	0.22	0.11	n/a	n/a
2	(51)	n/a	n/a	0.61	0.50	n/a	n/a	0.13	0.07	0.27	0.14	n/a	n/a
2-1/2	(64)	n/a	n/a	0.68	0.54	n/a	n/a	0.19	0.10	0.37	0.19	n/a	n/a
3	(76)	0.67	0.60	0.76	0.58	0.57	0.54	0.24	0.13	0.49	0.25	n/a	n/a
3-1/2	(89)	0.70	0.62	0.85	0.63	0.58	0.55	0.31	0.16	0.61	0.32	n/a	n/a
4	(102)	0.73	0.64	0.93	0.67	0.59	0.56	0.38	0.19	0.75	0.39	n/a	n/a
4-1/2	(114)	0.76	0.65	1.00	0.72	0.60	0.56	0.45	0.23	0.90	0.46	n/a	n/a
5	(127)	0.79	0.67		0.77	0.61	0.57	0.52	0.27	1.00	0.54	n/a	n/a
5-1/2	(140)	0.81	0.69		0.81	0.62	0.58	0.60	0.31		0.63	n/a	n/a
6	(152)	0.84	0.71		0.87	0.63	0.58	0.69	0.36		0.71	0.72	n/a
7	(178)	0.90	0.74		0.97	0.65	0.60	0.87	0.45		0.90	0.78	n/a
8	(203)	0.96	0.78		1.00	0.67	0.61	1.00	0.55		1.00	0.83	n/a
8-1/8	(206)	0.96	0.78			0.68	0.61		0.56			0.84	0.67
9	(229)	1.00	0.81			0.70	0.63		0.66			0.88	0.71
10	(254)		0.84			0.72	0.64		0.77			0.93	0.75
11	(279)		0.88			0.74	0.65		0.89			0.98	0.78
12	(305)		0.91			0.76	0.67		1.00			1.00	0.82
14	(356)		0.98			0.80	0.70						0.89
16	(406)		1.00			0.85	0.72						0.95
18	(457)					0.89	0.75						1.00
20	(508)					0.93	0.78						
24	(610)					1.00	0.84						
30	(762)						0.92						
> 36	(914)						1.00						

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering software or perform anchor calculation using design equations from ACI 318 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

Table 16 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the soffit of uncracked lightweight concrete over metal deck[1,2,3,4,5,6]

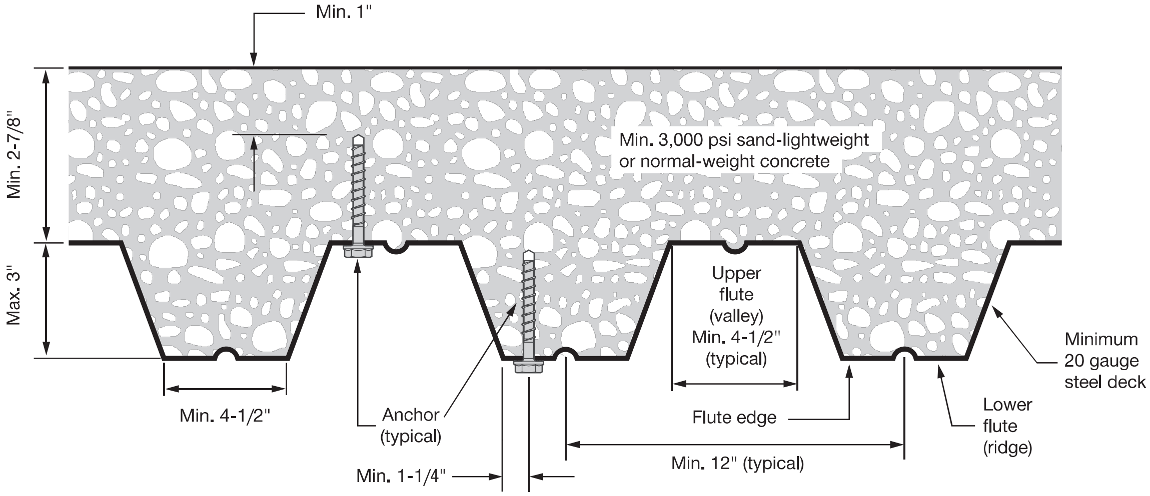
Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - ϕN_n		Shear - ϕV_n		Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)
1/4	1-5/8 (41)	545 (2.4)	595 (2.6)	725 (3.2)	725 (3.2)	670 (3.0)	730 (3.2)	725 (3.2)	725 (3.2)
	2-1/2 (64)	1,220 (5.4)	1,410 (6.3)	1,325 (5.9)	1,325 (5.9)	1,275 (5.7)	1,470 (6.5)	1,960 (8.7)	1,960 (8.7)
3/8	1-5/8 (41)	845 (3.8)	975 (4.3)	905 (4.0)	905 (4.0)	970 (4.3)	1,120 (5.0)	2,200 (9.8)	2,200 (9.8)
	2-1/2 (64)	1,455 (6.5)	1,680 (7.5)	905 (4.0)	905 (4.0)	1,900 (8.5)	2,195 (9.8)	3,655 (16.3)	3,655 (16.3)
	3-1/4 (83)	2,550 (11.3)	2,945 (13.1)	2,165 (9.6)	2,165 (9.6)	n/a	n/a	n/a	n/a
1/2	2-1/4 (57)	850 (3.8)	980 (4.4)	965 (4.3)	965 (4.3)	905 (4.0)	1,045 (4.6)	4,710 (21.0)	4,710 (21.0)
	3 (76)	1,990 (8.9)	2,300 (10.2)	1,750 (7.8)	1,750 (7.8)	n/a	n/a	n/a	n/a
	4-1/4 (108)	3,485 (15.5)	4,025 (17.9)	2,155 (9.6)	2,155 (9.6)	n/a	n/a	n/a	n/a
5/8	3-1/4 (83)	2,715 (12.1)	3,135 (13.9)	2,080 (9.3)	2,080 (9.3)	n/a	n/a	n/a	n/a
	5 (127)	6,170 (27.4)	7,125 (31.7)	2,515 (11.2)	2,515 (11.2)	n/a	n/a	n/a	n/a
3/4	4 (102)	2,715 (12.1)	3,135 (13.9)	2,255 (10.0)	2,255 (10.0)	n/a	n/a	n/a	n/a

Table 17 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the soffit of cracked lightweight concrete over metal deck[1,2,3,4,5,6]

Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - ϕN_n[7]		Shear - ϕV_n[8]		Tension - ϕN_n[7]		Shear - ϕV_n[8]	
		f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)
1/4	1-5/8 (41)	280 (1.2)	305 (1.4)	725 (3.2)	725 (3.2)	340 (1.5)	370 (1.6)	725 (3.2)	725 (3.2)
	2-1/2 (64)	605 (2.7)	700 (3.1)	1,325 (5.9)	1,325 (5.9)	635 (2.8)	735 (3.3)	1,960 (8.7)	1,960 (8.7)
3/8	1-5/8 (41)	525 (2.3)	605 (2.7)	905 (4.0)	905 (4.0)	770 (3.4)	890 (4.0)	2,200 (9.8)	2,200 (9.8)
	2-1/2 (64)	1,035 (4.6)	1,195 (5.3)	905 (4.0)	905 (4.0)	1,345 (6.0)	1,555 (6.9)	3,655 (16.3)	3,655 (16.3)
	3-1/4 (83)	1,805 (8.0)	2,085 (9.3)	2,165 (9.6)	2,165 (9.6)	n/a	n/a	n/a	n/a
1/2	2-1/4 (57)	535 (2.4)	620 (2.8)	965 (4.3)	965 (4.3)	640 (2.8)	740 (3.3)	4,710 (21.0)	4,710 (21.0)
	3 (76)	1,255 (5.6)	1,450 (6.4)	1,750 (7.8)	1,750 (7.8)	n/a	n/a	n/a	n/a
	4-1/4 (108)	2,195 (9.8)	2,535 (11.3)	2,155 (9.6)	2,155 (9.6)	n/a	n/a	n/a	n/a
5/8	3-1/4 (83)	1,710 (7.6)	1,975 (8.8)	2,080 (9.3)	2,080 (9.3)	n/a	n/a	n/a	n/a
	5 (127)	3,885 (17.3)	4,485 (20.0)	2,515 (11.2)	2,515 (11.2)	n/a	n/a	n/a	n/a
3/4	4 (102)	1,710 (7.6)	1,975 (8.8)	2,255 (10.0)	2,255 (10.0)	n/a	n/a	n/a	n/a

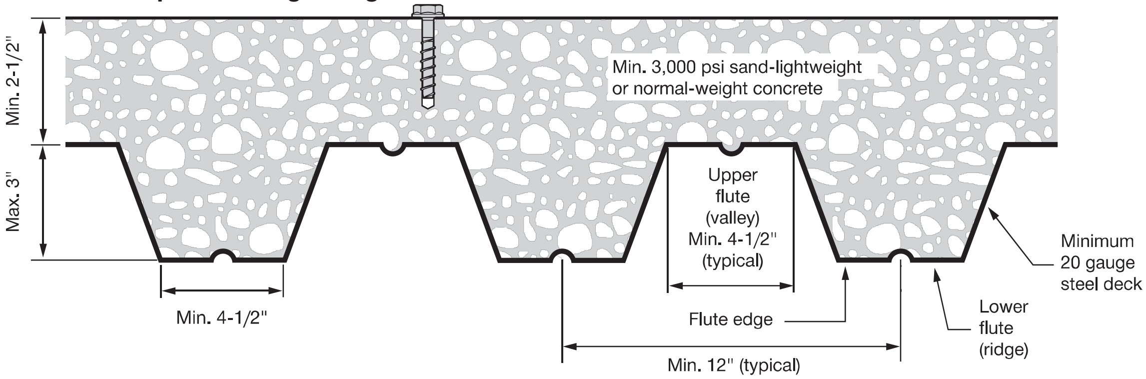
1 See PTG Ed. 21 Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{nom} (nominal embedment).
4 Tabular values are lightweight concrete and no additional reduction factor is needed.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Comparison to steel values in table 4 is not required. Values in tables 16 and 17 control.
7 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis}$ = 0.75. See PTG Ed. 21 Section 3.1.8 for additional information on seismic applications.
8 For the following anchor sizes, an additional factor for seismic shear must be applied to the cracked concrete tabular values for seismic conditions:
1/4-inch diameter - $\alpha_{v,seis}$ = 0.75
3/8-inch diameter - $\alpha_{v,seis}$ = 0.60
1/2-inch diameter - $\alpha_{v,seis}$ = 0.60
5/8-inch diameter - $\alpha_{v,seis}$ = 0.60
3/4-inch diameter - $\alpha_{v,seis}$ = 0.70

Figure 3 — Installation of Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in soffit of concrete over steel deck floor and roof assemblies[1]



1 Anchors may be placed in the upper or lower flute of the steel deck profile provided the minimum concrete cover above the drilled hole is satisfied. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

Figure 4 — Installation of Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC on the top of sand-lightweight concrete over metal floor and roof assemblies



3.3.6

Table 18 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the top of uncracked concrete over metal deck[1,2,3,4,5]

Nominal anchor diameter in.	Nominal embedment depth in. (mm)	Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
1/4	1-5/8 (41)	620 (2.8)	675 (3.0)	1,180 (5.2)	1,360 (6.0)
3/8	1-5/8 (41)	1,000 (4.4)	1,155 (5.1)	1,075 (4.8)	1,245 (5.5)

Table 19 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the top of cracked concrete over metal deck[1,2,3,4,5]

Nominal anchor diameter in.	Nominal embed. depth in. (mm)	Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
1/4	1-5/8 (41)	315 (1.4)	345 (1.5)	835 (3.7)	965 (4.3)
3/8	1-5/8 (41)	520 (2.3)	600 (2.7)	760 (3.4)	880 (3.9)

1 See PTG Ed. 21 Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 20 and 21 as necessary. Compare to the steel values in table 4. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-inch diameter - $\alpha_{N,seis}$ = 0.60
3/8-inch diameter- $\alpha_{N,seis}$ = 0.75.
No reduction needed for seismic shear. See PTG Ed. 21 Section 3.1.8 for additional information on seismic applications.

Table 20 — Load adjustment factors for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the top of uncracked concrete over metal deck[1,2]

1/4-in. and 3/8-in. KH-EZ uncracked concrete over metal deck			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear ⊥ toward edge f_{RV}		Edge distance in shear II to and away from edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Anchor diameter d_a		in. (mm)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)
Nominal embed. h_{nom}		in. (mm)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.44	0.58	n/a	n/a	0.44	0.58	0.44	0.58	n/a	n/a
	2	(51)	n/a	n/a	0.50	0.67	n/a	n/a	0.50	0.67	0.50	0.67	n/a	n/a
	2-1/2	(64)	n/a	n/a	0.63	0.83	n/a	n/a	0.63	0.83	0.63	0.83	0.78	0.83
	3	(76)	0.92	0.95	0.75	1.00	0.68	0.71	0.75	1.00	0.75	1.00	0.85	0.91
	3-1/4	(83)	0.96	0.99	0.81		0.70	0.72	0.81		0.81			
	3-1/2	(89)	0.99	1.00	0.88		0.71	0.74	0.88		0.88			
	4	(102)	1.00		1.00		0.74	0.78	1.00		1.00			
	4-1/2	(114)					0.77	0.81						
	5	(127)					0.80	0.84						
	5-1/2	(140)					0.83	0.88						
	6	(152)					0.86	0.91						
	6-1/2	(165)					0.89	0.95						
	7	(178)					0.92	0.98						
	7-1/2	(191)					0.95	1.00						
	8	(203)					0.98							
	9	(229)					1.00							

Table 21 — Load adjustment factors for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the top of cracked concrete over metal deck[1,2]

1/4-in. and 3/8-in. KH-EZ cracked concrete over metal deck			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear ⊥ toward edge f_{RV}		Edge distance in shear II to and away from edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Anchor diameter d_a		in. (mm)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)
Nominal embed. h_{nom}		in. (mm)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.99	1.00	n/a	n/a	0.51	0.62	0.99	1.00	n/a	n/a
	2	(51)	n/a	n/a	1.00		n/a	n/a	0.62	0.76	1.00		n/a	n/a
	2-1/2	(64)	n/a	n/a			n/a	n/a	0.87	1.00			0.78	0.83
	3	(76)	0.92	0.95			0.68	0.71	1.00				0.85	0.91
	3-1/4	(83)	0.96	0.99			0.70	0.73						
	3-1/2	(89)	0.99	1.00			0.71	0.74						
	4	(102)	1.00				0.74	0.78						
	4-1/2	(114)					0.77	0.81						
	5	(127)					0.80	0.85						
	5-1/2	(140)					0.83	0.88						
	6	(152)					0.86	0.92						
	6-1/2	(165)					0.89	0.95						
	7	(178)					0.92	0.98						
	7-1/2	(191)					0.95	1.00						
	8	(203)					0.98							
	9	(229)					1.00							

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering software or perform anchor calculation using design equations from ACI 318 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

- For concrete thickness greater than or equal to 3-1/4-inches, the anchor can be designed using either table 2 or table 3 of this section.

DESIGN INFORMATION IN CONCRETE PER CSA A23.3

Limit State Design of anchors is described in the provisions of CSA A23.3 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. This section contains the Limit State Design tables with unfactored characteristic loads that are based on the published loads in ICC Evaluation Services ESR-3027. These tables are followed by factored resistance tables. The factored resistance tables have characteristic design loads that are prefactored by the applicable reduction factors for a single anchor with no anchor-to-anchor spacing or edge distance adjustments for the convenience of the user of this document. All the figures in the previous ACI 318 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

For a detailed explanation of the tables developed in accordance with CSA A23.3 Annex D, refer to Section 3.1.8. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.com.

Table 22 — Steel resistance for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC carbon steel screw anchor[1,2]

Nominal anchor diameter in.	Nominal embedment in. (mm)			Tensile [3] N_{sar} lb (kN)	Shear [4] V_{sar} lb (kN)	Seismic shear [5] $V_{sar,eq}$ lb (kN)
1/4	1-5/8 (41)	2-1/2 (64)		3,370 (15.0)	855 (3.8)	770 (3.4)
3/8	1-5/8 (41)	2-1/8 (54)		5,475 (24.4)	2,030 (9.0)	2,030 (9.0)
3/8	2-1/2 (64)	3-1/4 (83)		6,150 (27.4)	2,865 (12.7)	1,720 (7.7)
1/2	2-1/4 (57)	3 (76)	4-1/4 (108)	10,780 (48.0)	5,110 (22.7)	3,065 (13.6)
5/8	3-1/4 (83)	4 (102)	5 (127)	14,405 (64.1)	6,200 (27.6)	3,720 (16.5)
3/4	4 (102)	6-1/4 (159)		19,050 (84.7)	9,205 (40.9)	6,385 (28.4)

1 See PTG Ed. 21 Section 3.1.8 to convert design strength value to ASD value.
2 Hilti KH-EZ carbon steel screw anchors are to be considered brittle steel elements.
3 Tensile $N_{sar} = A_{se,N}\ \phi_s\ f_{uta}\ R$ as noted in CSA A23.3 Annex D.
4 Shear determined by static shear tests with $V_{sar} < 0.6\ A_{se,V}\ \phi_s\ f_{uta}\ R$ as noted in CSA A23.3 Annex D.
5 Seismic shear values determined by seismic shear tests with $V_{sar,eq} \leq 0.60\ A_{se,V}\ \phi_s\ f_{uta}\ R$ as noted in CSA A23.3 Annex D. See PTG Ed. 21 Section 3.1.9 for additional information on seismic applications.

Table 23 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC design information in accordance with CSA A23.3 Annex D1[1]

Design parameter	Symbol	Units	Nominal anchor diameter														Ref
			1/4		3/8				1/2			5/8			3/4		A23.3
Head Style and coating			Hex, P, PM, PL, C head		Hex, C head		Hex, C head (Including CRC)		Hex head (Including CRC)			Hex head (Including CRC)			Hex head (Including CRC)		
Nominal anchor diameter	d_a	in. (mm)	0.25 (6.4)		0.375 (9.5)				0.5 (12.7)			0.625 (15.9)			0.75 (19.1)		
Effective embedment[2]	h_{ef}	in. (mm)	1.18 (30)	1.92 (49)	1.11 (28)	1.54 (39)	1.86 (47)	2.50 (64)	1.52 (39)	2.16 (55)	3.22 (82)	2.39 (61)	3.03 (77)	3.88 (99)	2.92 (74)	4.84 (123)	
Min. nominal embedment[2]	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/8 (54)	2-1/2 (64)	3-1/4 (83)	2-1/4 (57)	3 (76)	4-1/4 (108)	3-1/4 (83)	4 (102)	5 (127)	4 (102)	6-1/4 (159)	
Minimum concrete thickness[3]	h_{min}	in. (mm)	3-1/4 (83)	4-1/8 (105)	3-1/4 (83)	3-2/3 (93)	4 (102)	4-3/4 (121)	4-1/2 (114)	4-3/4 (121)	6-3/4 (171)	5 (127)	6 (152)	7 (178)	6 (152)	8-1/8 (206)	
Critical edge distance	c_{ac}	in. (mm)	2 (51)	2.78 (71)	2.63 (67)	2.75 (70)	2.92 (74)	3.75 (95)	2.75 (70)	3.75 (95)	5.25 (133)	3.63 (92)	4.57 (116)	5.82 (148)	4.41 (112)	7.28 (185)	
Minimum spacing at critical edge distance	$s_{min,cac}$	in. (mm)	1.5 (38)		2.25 (57)				3 (76)								
Minimum edge distance	c_{min}	in. (mm)	1.50 (38)						1.75 (44)								
Minimum anchor spacing at minimum edge distance	for s >	in. (mm)	3.0 (76)									4 (102)					
Mininimum hole depth in concrete	h_0	in. (mm)	2 (51)	2-7/8 (73)	1-7/8 (48)	2-3/8 (60)	2-3/4 (70)	3-1/2 (89)	2-5/8 (67)	3-3/8 (86)	4-5/8 (117)	3-5/8 (92)	4-3/8 (111)	5-3/8 (137)	4-3/8 (111)	6-5/8 (168)	
Minimum specified ultimate strength	f_{uta}	psi (N/mm²)	125,000 (860)		106,975 (738)		120,300 (830)		112,540 (776)			90,180 (622)			81,600 (563)		
Effective tensile stress area	$A_{se,N}$	in² (mm²)	0.045 (29.0)		0.086 (55.5)				0.161 (103.9)			0.268 (172.9)			0.392 (252.9)		
Steel embed. material resistance factor for reinforcement	ϕ_s	-	0.85														8.4.3
Resistance modification factor for tension, steel failure modes[4]	R	-	0.70														D.5.3
Resistance modification factor for shear, steel failure modes[4]	R	-	0.65														D.5.3
Factored steel resistance in tension	N_{sar}	lb (kN)	3,370 (15.0)		5,475 (24.4)		6,150 (27.4)		10,780 (48.0)			14,405 (64.1)			19,050 (84.7)		D.6.1.2
Factored steel resistance in shear	V_{sar}	lb (kN)	855 (3.8)		2,030 (9.0)		2,865 (12.7)		5,110 (22.7)			6,200 (27.6)			9,205 (40.9)		D.7.1.2
Factored steel resistance in shear, seismic	$V_{sar,eq}$	lb (kN)	770 (3.4)		2,030 (9.0)		1,720 (7.7)		3,065 (13.6)			3,720 (16.5)			6,385 (28.4)		
Coeff. for factored conc. breakout resistance, uncracked concrete	$k_{c,uncr}$	lb	10						11.25								D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$	-	7														D.6.2.2
Modification factor for anchor resistance, tension, uncracked concrete[5]	$\psi_{c,N}$	-	1.0														D.6.2.6
Anchor category	-	-	3	1													D.5.3 (c)
Concrete material resistance factor	ϕ_c	-	0.65														8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B[6]	R	-	0.75	1.00													D.5.3 (c)
Factored pullout resistance in 20 MPa uncracked concrete[7]	$N_{pr,uncr}$	lb (kN)	665 (3.0)	1,645 (7.3)	NA												D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete[7]	$N_{pr,cr}$	lb (kN)	340 (1.5)	815 (3.6)	510 (2.3)	NA											D.6.3.2
Factored seismic pullout resistance in 20 MPa cracked concrete[7]	$N_{pr,eq}$	lb (kN)	275 (1.2)	815 (3.6)	510 (2.3)	NA											D.6.3.2

1 Design information in this table is taken from ICC-ES ESR-3027, tables 1, 3, and 5, and converted for use with CSA A23.3 Annex D.
2 See Figure 1 on Page 2 of this document.
3 For concrete over metal deck applications where the concrete thickness over the top flute is less than h_{min} in this table, see figure 4 and tables 20 and 21 of this document.
4 The KH-EZ is considered a brittle steel element as defined by CSA A23.3 Annex D section D.2.
5 For all design cases, $\psi_{c,N}$ = 1.0. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
6 For use with the load combinations of CSA A23.3 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.
7 For all design cases, $\psi_{c,P}$ = 1.0. NA (not applicable) denotes that this value does not control for design. See section 4.1.4 of ESR-3027 for additional information.

Table 24 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC carbon steel screw anchor factored resistance with concrete/pullout failure in uncracked concrete[1,2,3,4]

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r				Shear - V_r			
			f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	1.18 (30)	1-5/8 (41)	665 (3.0)	710 (3.2)	750 (3.3)	820 (3.6)	805 (3.6)	900 (4.0)	985 (4.4)	1,135 (5.1)
	1.92 (49)	2-1/2 (64)	1,645 (7.3)	1,840 (8.2)	2,015 (9.0)	2,325 (10.4)	2,225 (9.9)	2,490 (11.1)	2,725 (12.1)	3,145 (14.0)
3/8	1.11 (28)	1-5/8 (41)	980 (4.4)	1,095 (4.9)	1,200 (5.3)	1,385 (6.2)	980 (4.4)	1,095 (4.9)	1,200 (5.3)	1,385 (6.2)
	1.54 (39)	2-1/8 (54)	1,600 (7.1)	1,785 (8.0)	1,960 (8.7)	2,260 (10.1)	1,600 (7.1)	1,785 (8.0)	1,960 (8.7)	2,260 (10.1)
	1.86 (47)	2-1/2 (64)	2,120 (9.4)	2,375 (10.6)	2,600 (11.6)	3,000 (13.3)	2,120 (9.4)	2,375 (10.6)	2,600 (11.6)	3,000 (13.3)
	2.50 (64)	3-1/4 (83)	3,305 (14.7)	3,695 (16.4)	4,050 (18.0)	4,675 (20.8)	3,305 (14.7)	3,695 (16.4)	4,050 (18.0)	4,675 (20.8)
1/2	1.52 (39)	2-1/4 (57)	1,765 (7.8)	1,970 (8.8)	2,160 (9.6)	2,495 (11.1)	1,765 (7.8)	1,970 (8.8)	2,160 (9.6)	2,495 (11.1)
	2.16 (55)	3 (76)	2,990 (13.3)	3,340 (14.9)	3,660 (16.3)	4,225 (18.8)	2,990 (13.3)	3,340 (14.9)	3,660 (16.3)	4,225 (18.8)
	3.22 (82)	4-1/4 (108)	5,440 (24.2)	6,080 (27.0)	6,660 (29.6)	7,690 (34.2)	10,875 (48.4)	12,160 (54.1)	13,320 (59.3)	15,380 (68.4)
5/8	2.39 (61)	3-1/4 (83)	3,475 (15.5)	3,890 (17.3)	4,260 (18.9)	4,920 (21.9)	3,475 (15.5)	3,890 (17.3)	4,260 (18.9)	4,920 (21.9)
	3.03 (77)	4 (102)	4,985 (22.2)	5,573 (24.8)	6,105 (27.2)	7,049 (31.4)	10,736 (47.8)	12,004 (53.4)	13,149 (58.5)	15,183 (67.5)
	3.88 (99)	5 (127)	7,195 (32.0)	8,040 (35.8)	8,810 (39.2)	10,170 (45.2)	14,385 (64.0)	16,085 (71.5)	17,620 (78.4)	20,345 (90.5)
3/4	2.92 (74)	4 (102)	4,695 (20.9)	5,250 (23.4)	5,750 (25.6)	6,640 (29.5)	9,390 (41.8)	10,500 (46.7)	11,505 (51.2)	13,280 (59.1)
	4.84 (123)	6-1/4 (159)	10,020 (44.6)	11,205 (49.8)	12,275 (54.6)	14,170 (63.0)	20,040 (89.2)	22,410 (99.7)	24,545 (109.2)	28,345 (126.1)

3.3.6

Table 25 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC carbon steel screw anchor factored resistance with concrete/pullout failure in cracked concrete[1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r				Shear - V_r			
			f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	1.18 (30)	1-5/8 (41)	340 (1.5)	360 (1.6)	385 (1.7)	415 (1.9)	565 (2.5)	630 (2.8)	690 (3.1)	795 (3.5)
	1.92 (49)	2-1/2 (64)	815 (3.6)	910 (4.1)	1,000 (4.4)	1,155 (5.1)	1,560 (6.9)	1,740 (7.7)	1,910 (8.5)	2,205 (9.8)
3/8	1.11 (28)	1-5/8 (41)	510 (2.3)	570 (2.5)	620 (2.8)	720 (3.2)	685 (3.0)	765 (3.4)	840 (3.7)	970 (4.3)
	1.54 (39)	2-1/8 (54)	1,120 (5.0)	1,250 (5.6)	1,370 (6.1)	1,585 (7.0)	1,120 (5.0)	1,250 (5.6)	1,370 (6.1)	1,585 (7.0)
	1.86 (47)	2-1/2 (64)	1,485 (6.6)	1,660 (7.4)	1,820 (8.1)	2,100 (9.3)	1,485 (6.6)	1,660 (7.4)	1,820 (8.1)	2,100 (9.3)
	2.50 (64)	3-1/4 (83)	2,315 (10.3)	2,590 (11.5)	2,835 (12.6)	3,275 (14.6)	2,315 (10.3)	2,590 (11.5)	2,835 (12.6)	3,275 (14.6)
1/2	1.52 (39)	2-1/4 (57)	1,095 (4.9)	1,225 (5.5)	1,345 (6.0)	1,550 (6.9)	1,095 (4.9)	1,225 (5.5)	1,345 (6.0)	1,550 (6.9)
	2.16 (55)	3 (76)	1,860 (8.3)	2,080 (9.2)	2,275 (10.1)	2,630 (11.7)	1,860 (8.3)	2,080 (9.2)	2,275 (10.1)	2,630 (11.7)
	3.22 (82)	4-1/4 (108)	3,385 (15.1)	3,785 (16.8)	4,145 (18.4)	4,785 (21.3)	6,765 (30.1)	7,565 (33.7)	8,290 (36.9)	9,570 (42.6)
5/8	2.39 (61)	3-1/4 (83)	2,165 (9.6)	2,420 (10.8)	2,650 (11.8)	3,060 (13.6)	2,165 (9.6)	2,420 (10.8)	2,650 (11.8)	3,060 (13.6)
	3.03 (77)	4 (102)	3,139 (14.0)	3,509 (15.6)	3,844 (17.1)	4,439 (19.7)	6,760 (30.1)	7,558 (33.6)	8,279 (36.8)	9,560 (42.5)
	3.88 (99)	5 (127)	4,475 (19.9)	5,005 (22.3)	5,480 (24.4)	6,330 (28.2)	8,950 (39.8)	10,005 (44.5)	10,965 (48.8)	12,660 (56.3)
3/4	2.92 (74)	4 (102)	2,920 (13.0)	3,265 (14.5)	3,580 (15.9)	4,130 (18.4)	5,845 (26.0)	6,535 (29.1)	7,155 (31.8)	8,265 (36.8)
	4.84 (123)	6-1/4 (159)	6,235 (27.7)	6,970 (31.0)	7,635 (34.0)	8,820 (39.2)	12,470 (55.5)	13,945 (62.0)	15,275 (67.9)	17,635 (78.4)

1 See PTG Ed. 21 Section 3.1.8 to convert factored resistance value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 6 to 15 as necessary. Compare to the steel values in table 22. The lesser of the values is to be used for the design.
4 Tablular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-in diameter by 1-5/8-in nominal embedment depth - $\alpha_{N,seis}$ = 0.60 All other sizes - $\alpha_{N,seis}$ = 0.75
No reduction needed for seismic shear. See PTG Ed. 21 Section 3.1.8 for additional information on seismic applications.

Table 26 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the soffit of uncracked lightweight concrete over metal deck[1,2,3,4,5,6]

Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - N_r		Shear - V_r		Tension - N_r		Shear - V_r	
		f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)
1/4	1-5/8 (41)	585 (2.6)	660 (2.9)	665 (3.0)	665 (3.0)	720 (3.2)	810 (3.6)	665 (3.0)	665 (3.0)
	2-1/2 (64)	1,200 (5.3)	1,470 (6.5)	1,220 (5.4)	1,220 (5.4)	1,255 (5.6)	1,535 (6.8)	1,805 (8.0)	1,805 (8.0)
3/8	1-5/8 (41)	830 (3.7)	1,020 (4.5)	835 (3.7)	835 (3.7)	950 (4.2)	1,165 (5.2)	2,030 (9.0)	2,030 (9.0)
	2-1/2 (64)	1,430 (6.4)	1,755 (7.8)	835 (3.7)	835 (3.7)	1,865 (8.3)	2,285 (10.2)	3,365 (15.0)	3,365 (15.0)
	3-1/4 (83)	2,505 (11.1)	3,070 (13.7)	1,990 (8.9)	1,990 (8.9)	n/a	n/a	n/a	n/a
1/2	2-1/4 (57)	835 (3.7)	1,020 (4.5)	885 (3.9)	885 (3.9)	890 (4.0)	1,090 (4.8)	4,335 (19.3)	4,335 (19.3)
	3 (76)	1,955 (8.7)	2,395 (10.7)	1,615 (7.2)	1,615 (7.2)	n/a	n/a	n/a	n/a
	4-1/4 (108)	3,425 (15.2)	4,195 (18.7)	1,985 (8.8)	1,985 (8.8)	n/a	n/a	n/a	n/a
5/8	3-1/4 (83)	2,670 (11.9)	3,270 (14.5)	1,915 (8.5)	1,915 (8.5)	n/a	n/a	n/a	n/a
	5 (127)	6,070 (27.0)	7,430 (33.1)	2,315 (10.3)	2,315 (10.3)	n/a	n/a	n/a	n/a
3/4	4 (102)	2,670 (11.9)	3,270 (14.5)	2,075 (9.2)	2,075 (9.2)	n/a	n/a	n/a	n/a

Table 27 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the soffit of cracked lightweight concrete over metal deck[1,2,3,4,5,6]

Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - N_r[7]		Shear - V_r[8]		Tension - N_r[7]		Shear - V_r[8]	
		f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)
1/4	1-5/8 (41)	300 (1.3)	340 (1.5)	665 (3.0)	665 (3.0)	365 (1.6)	445 (2.0)	665 (3.0)	665 (3.0)
	2-1/2 (64)	595 (2.6)	730 (3.2)	1,220 (5.4)	1,220 (5.4)	625 (2.8)	765 (3.4)	1,805 (8.0)	1,805 (8.0)
3/8	1-5/8 (41)	520 (2.3)	635 (2.8)	835 (3.7)	835 (3.7)	755 (3.4)	930 (4.1)	2,030 (9.0)	2,030 (9.0)
	2-1/2 (64)	1,015 (4.5)	1,245 (5.5)	835 (3.7)	835 (3.7)	1,325 (5.9)	1,620 (7.2)	3,365 (15.0)	3,365 (15.0)
	3-1/4 (83)	1,775 (7.9)	2,175 (9.7)	1,990 (8.9)	1,990 (8.9)	n/a	n/a	n/a	n/a
1/2	2-1/4 (57)	525 (2.3)	640 (2.8)	885 (3.9)	885 (3.9)	630 (2.8)	770 (3.4)	4,335 (19.3)	4,335 (19.3)
	3 (76)	1,235 (5.5)	1,510 (6.7)	1,615 (7.2)	1,615 (7.2)	n/a	n/a	n/a	n/a
	4-1/4 (108)	2,155 (9.6)	2,640 (11.7)	1,985 (8.8)	1,985 (8.8)	n/a	n/a	n/a	n/a
5/8	3-1/4 (83)	1,680 (7.5)	2,060 (9.2)	1,915 (8.5)	1,915 (8.5)	n/a	n/a	n/a	n/a
	5 (127)	3,820 (17.0)	4,680 (20.8)	2,315 (10.3)	2,315 (10.3)	n/a	n/a	n/a	n/a
3/4	4 (102)	1,680 (7.5)	2,060 (9.2)	2,075 (9.2)	2,075 (9.2)	n/a	n/a	n/a	n/a

1 See PTG Ed. 21 Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compresive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{nom} (nominal embedment).
4 Tabular values are lightweight concrete and no additional reduction factor is needed.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Comparison of the tabular values to the steel strength is not necessary. Tabular values control.
7 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-in diameter by 1-5/8-in nominal embedment depth - $\alpha_{N,seis}$ = 0.60
All other sizes - $\alpha_{N,seis}$ = 0.75.
See PTG Ed. 21 Section 3.1.8 for additional information on seismic applications.
8 For the following anchor sizes, an additional factor for seismic shear must be applied to the cracked concrete tabular values for seismic conditions:
1/4-inch diameter - $\alpha_{v,seis}$ = 0.75
3/8-inch diameter - $\alpha_{v,seis}$ = 0.60
1/2-inch diameter - $\alpha_{v,seis}$ = 0.60
5/8-inch diameter - $\alpha_{v,seis}$ = 0.60
3/4-inch diameter - $\alpha_{v,seis}$ = 0.70

Table 28 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC steel screw anchor factored resistance in the top of uncracked concrete over metal deck[1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r		Shear - V_r	
			f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
1/4	1.18	1-5/8	665	750	805	985
	(30)	(41)	(3.0)	(3.3)	(3.6)	(4.4)
3/8	1.11	1-5/8	980	1,200	980	1,200
	(28)	(41)	(4.4)	(5.3)	(4.4)	(5.3)

Table 29 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC steel anchor factored resistance in the top of cracked concrete over metal deck[1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r		Shear - V_r	
			f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
1/4	1.18	1-5/8	340	385	565	690
	(30)	(41)	(1.5)	(1.7)	(2.5)	(3.1)
3/8	1.11	1-5/8	510	620	685	840
	(28)	(41)	(2.3)	(2.8)	(3.0)	(3.7)

1 See PTG Ed. 21 Section 3.1.8 to convert design strength value to ASD value.

2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.

3 Apply spacing, edge distance, and concrete thickness factors in tables 20 and 21 as necessary. Compare to the steel values in table 22. The lesser of the values is to be used for the design.

4 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows:
for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60

5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-inch diameter - $\alpha_{N,seis}$ = 0.60
3/8-inch diameter- $\alpha_{N,seis}$ = 0.75.
No reduction needed for seismic shear. See PTG Ed. 21 Section 3.1.8 for additional information on seismic applications.

DESIGN INFORMATION IN MASONRY

Table 30 — Allowable tension loads for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC installed in grout-filled masonry walls (lb)[1,2,3,4,5]

Nominal anchor diameter in.	Embedment in.[6]	Loads @ c_{cr} and s_{cr}	Spacing: Critical - s_{cr} in.[7]	Spacing: Minimum - s_{min} in.[7]	Spacing: Load reduction factor at s_{min}[8]	Edge distance: Critical - c_{cr} Minimum- c_{min} in.[9]
1/4	1-5/8	530[10]	4	2	0.70	4
	2-1/2	910[11]		4	1.00	
3/8	1-5/8	535[11]	4	2	0.70	4
	2-1/2	895	6	4	0.80	
	3-1/4	1,210				
1/2	2-1/4	710	4	2	0.60	4
	3	1,110	8	4		
	4-1/4	1,515				
5/8	3-1/4	1,155	10	4	0.60	4
	5	1,735				
3/4	4	1,680	12	4	0.60	4
	6-1/4	2,035				

Table 31 — Allowable shear loads for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC installed in grout-filled masonry walls (lb)[1,2,3,4,5]

Nominal anchor diameter in.	Embedment in.[6]	Load at c_{cr} and s_{cr}	Spacing: Critical - s_{cr} in.[7]	Spacing: Minimum - s_{min} in.[7]	Spacing: Load reduction factor at s_{min}[8]	Edge distance: Critical - c_{cr} in.[9]	Edge distance: Minimum - c_{min} in.[9]	Load reduction factor at c_{min}: perpendicular to edge	Load reduction factor at c_{min}: parallel to edge
1/4	1-5/8	675[10]	4	4	1.00	4	4	1.00	1.00
	2-1/2	840[11]						1.00	1.00
3/8	1-5/8	1,140[11]	6	4	0.94	6	4	0.61	1.00
	2-1/2	1,165						0.70	1.00
	3-1/4	1,190						0.70	1.00
1/2	2-1/4	1,845	8	4	0.88	8	4	0.50	1.00
	3	2,055						0.45	0.94
	4-1/4	2,745						0.40	0.89
5/8	3-1/4	3,040	10	4	0.36	10	4	0.36	0.82
	5	3,485						0.34	0.92
3/4	4	3,040	10	4	0.36	10	4	0.36	0.82
	6-1/4	3,485						0.34	0.92

1 All values are for anchors installed in fully grouted masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units may be lightweight, medium-weight or normal-weight.

2 Anchors may not be installed within one inch in any direction of a vertical joint.

3 Linear interpolation of load values between minimum spacing s_{min} and critical spacing s_{cr} and between minimum edge distance c_{min} and critical edge distance c_{cr} is permitted.

4 For combined loading: For 1/4-in. - $\frac{T_{applied}}{T_{allowable}} + \frac{V_{applied}}{V_{allowable}} \leq 1$ For 3/8- through 3/4-in. - $\left(\frac{T_{applied}}{T_{allowable}}\right)^{5/3} + \left(\frac{V_{applied}}{V_{allowable}}\right)^{5/3} \leq 1$

5 See Figure 5 on Page 21 of this document for anchor locations for anchor locations.

6 Embedment depth is measured from the outside face of the concrete masonry embedment.

7 Critical spacing s_{cr} is the anchor spacing where full load values may be used. The minimum spacing s_{min} is the minimum spacing for which values are available and installation is recommended. Spacing is measured from the center of one anchor to the center of the adjacent anchor.

8 Load reduction factors are multiplicative, both spacing and edge distance load reduction factors must be considered. Load values for anchors installed at less than c_{cr} or s_{cr} must be multiplied by the appropriate load reduction factor based on actual edge distance (c) or spacing (s).

9 The critical edge distance c_{cr} is the edge distance where full load values may be used. The minimum edge distance c_{min} is the minimum edge distance for which values are available and installation is recommended. For tension, c_{cr} equals c_{min}. Edge distance is measured from the center of the anchor to the closest edge.

10 Load values must be reduced by 21% for installations within 1-1/4 inches of the bed joint.

11 Load values must be reduced by 13% for installations within 1-1/4 inches of the bed joint.

Table 32 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC allowable loads installed in top-of-grout-filled concrete masonry walls or horizontal members of wall openings[1,2,3]

Nominal anchor diameter in.	Minimum embedment depth in.	Edge distance[4] in.	Critical spacing[5] in.	Minimum end distance[6] in.	Tension lb	Shear lb Load direction Parallel to edge of masonry wall	Shear lb Load direction Perpendicular to edge of masonry wall
1/4	1 5/8	1 1/2	4	4	205	180	135
		3 3/4			205	275	275
	2 1/2	1 1/2			355	345	155
		3 3/4			390	415	330
3/8	1 5/8	1 1/2	6	6	245	345	175
		3 3/4			245	345	345
	3 1/4	1 1/2			465	490	200
		3 3/4			540	800	625
1/2	2 1/4	1 3/4	8	8	390	460	200
		3 3/4			610	525	500
	4 1/4	1 3/4			540	885	245
		3 3/4			750	1275	550
5/8	5	1 3/4	10	10	975	930	245
		3 3/4			975	2190	630
3/4	6 1/4	3 3/4	12	12	975	2430	630

Table 33 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC allowable loads installed in end-of-wall or vertical members of wall openings[1,2]

Nominal anchor diameter in.	Minimum embedment depth in.	Edge distance[4] in.	Critical spacing[5] in.	Minimum end distance[6] in.	Tension lb	Shear lb Load direction Parallel to edge of masonry wall	Shear lb Load direction Perpendicular to edge of masonry wall
1/4	1 5/8	1 1/2	4	4	360	525	205
		3 3/4			380	595	585
	2 1/2	1 1/2			590	610	225
		3 3/4			755	635	585
3/8	1 5/8	1 1/2	6	6	355	725	215
		3 3/4			465	1010	825
	3 1/4	1 1/2			565	875	240
		3 3/4			1020	1195	1050
1/2	2 1/4	1 3/4	8	8	500	855	260
		3 3/4			525	1100	1050
	4 1/4	1 3/4			650	925	280
		3 3/4			1150	1240	1050
5/8	5	3 3/4	10	10	1605	2215	1050
3/4	6 1/4	3 3/4	12	12	1865	2550	1050

1 All values are for anchors installed in fully grouted concrete masonry with minimum masonry prism strength of 1,500 psi. Concrete masonry units may be lightweight, medium-weight or normal-weight conforming to ASTM C90. Allowable loads are calculated using safety factor of 5.

2 See figure 6 and 7 for allowable anchor installation locations on the top of grout-filled concrete masonry walls. Anchors may not be installed within one inch of a vertical joint. See figure 7 for anchor installation locations in end-of-wall and vertical members of wall openings.

3 Anchors may not be installed within 1-1/4" in any direction of a head joint.

4 For load values at edge distances between listed values linear interpolation is permitted.

5 Critical spacing equals minimum spacing.

6 Minimum end distance applicable to top-of-wall and end-of-wall and does not apply for wall openings such as windows.

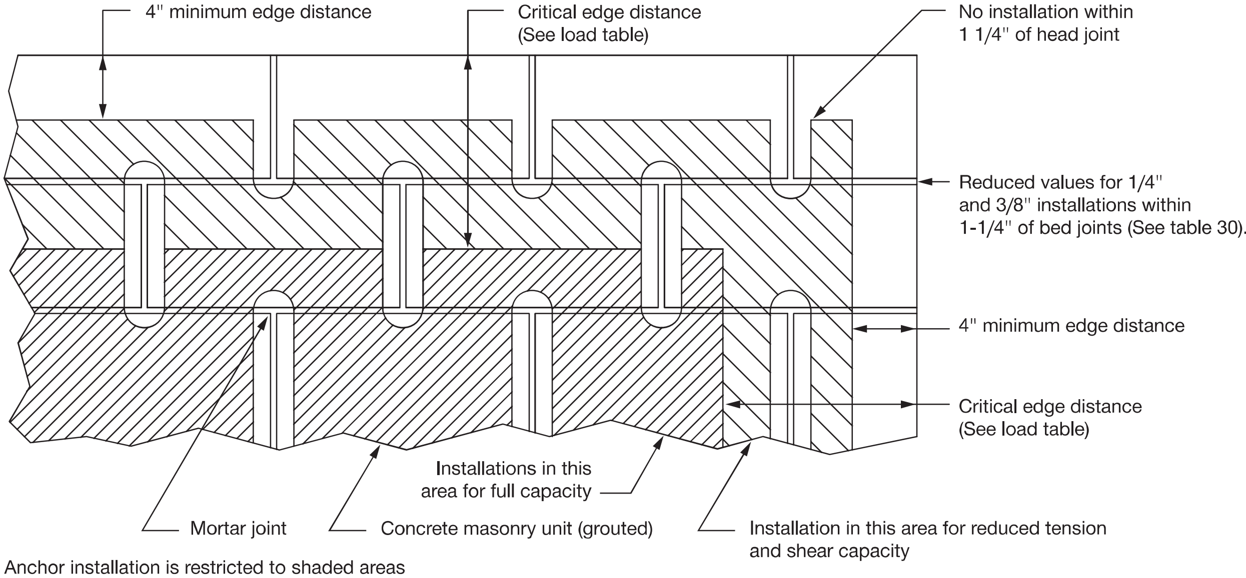


Figure 5 — Acceptable locations (shaded areas) for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC anchors in grout-filled concrete masonry

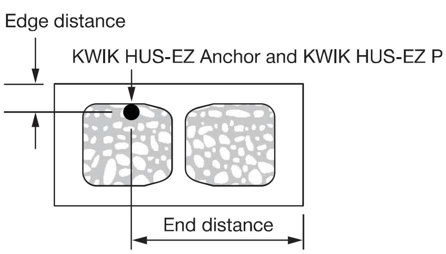


Figure 6 — Edge and end distances for the Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC anchor installed in the top of CMU masonry wall construction

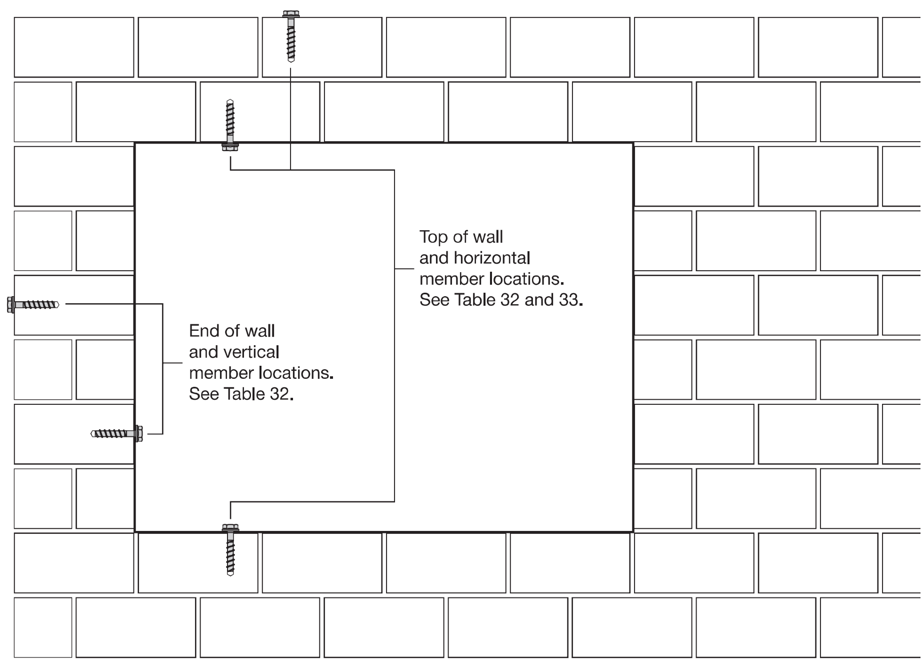


Figure 7 — Anchor locations in end of wall or wall opening applications

DESIGN INFORMATION IN HOLLOW CORE CONCRETE PER ALLOWABLE STRESS DESIGN

Table 34 — Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC allowable stress design values for installations into hollow core concrete panels[1,2]

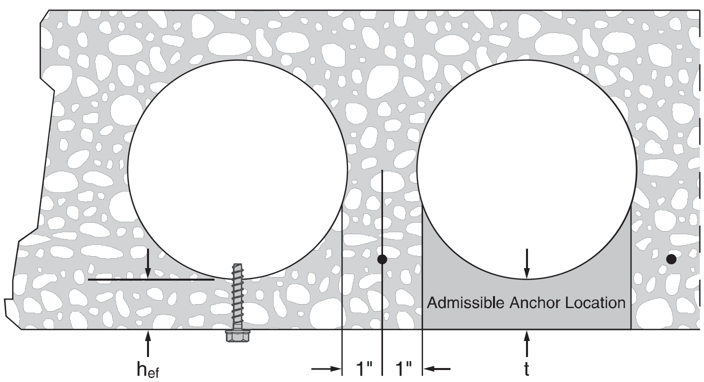
Anchor diameter (inches)	Min. effective embedment h_{ef} (inches)	Allowable load[3]		Ultimate load	
		Tension	Shear	Tension	Shear
1/4	1-1/8	400	610	1600	2440
	1-3/8	455	755	1810	3025
3/8	1-1/8	435	890	1740	3560
	1-3/8	590 (2.6)	1405 (6.3)	2360 (10.5)	5620 (25.0)

1 The admissible anchor location must be established to prevent damage to the prestressed cable during the drilling process. Verify the location and height of the cable with the hollow core plank supplier to confirm admissible anchor location.

2 Minimum compressive strength of prestressed concrete is 7,000 psi. Published ultimate loads represent the average results conducted in local base materials. Due to variations in materials and dimensionl configurations, on-site testing is required to determine the actual performance.

3 Allowable loads calculated with a factor of safety of 4.

Figure 8 — Installation of Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in hollow core concrete

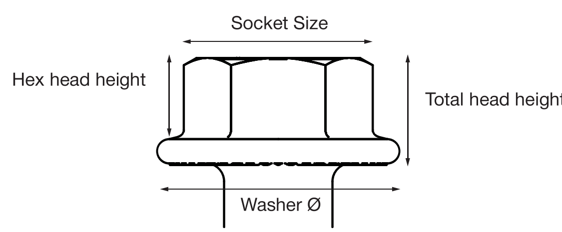


3.3.6

KH-EZ (CRC)

KH-EZ Ø	Socket Size	Washer Ø	Total head height	Hex head height
1/4”	7/16”	0.65”	0.24”	0.16”
3/8”	9/16”	0.78”	0.35”	0.26”
1/2”	3/4”	1.03”	0.49”	0.35”
5/8”	15/16”	1.28”	0.57”	0.43”
3/4”	1-1/8”	1.48”	0.70”	0.53”

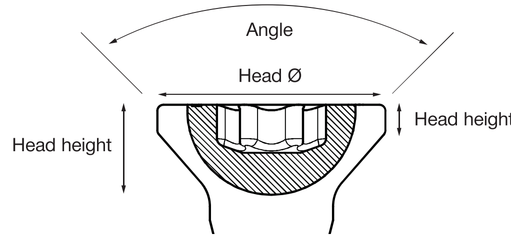
1 KH-EZ CRC does not come in ¼“ diameter.
Ø = diameter



KH-EZ C

KH-EZ Ø	Torx Size	Head Ø	Head height	Flat height	Angle
1/4”	TX30	0.47”	0.16”	0.04”	82°
3/8”	TX50	0.74”	0.28”	0.09”	82°

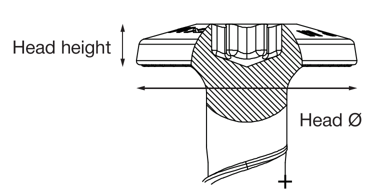
Ø = diameter



KH-EZ P/PM/PL

Pan Size	Torx Size	Head Ø	Head height
P	TX30	0.52”	0.13”
PM	TX30	0.69”	0.13”
PL	TX30	0.86”	0.18”

Ø = diameter



INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at **www.hilti.com**. Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

ORDERING INFORMATION

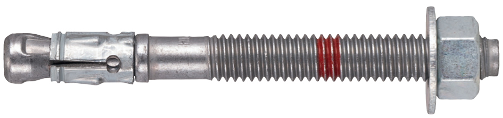
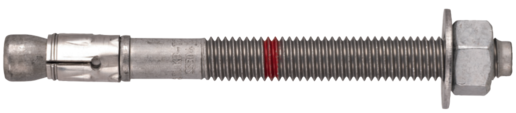
Order Information

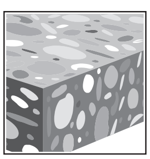
Description	Hole Diameter	Total Length without Anchor Head	Minimum Embedment Depth	Qty (pcs) / Box
KH-EZ P 1/4''x1 7/8''	1/4''	1 7/8	1 5/8	100
KH-EZ P 1/4''x2 5/8''	1/4''	2 5/8	1 5/8	100
KH-EZ PM 1/4''x2 5/8''	1/4''	2 5/8	1 5/8	100
KH-EZ PM 1/4''x1 7/8''	1/4''	1 7/8	1 5/8	100
KH-EZ PL 1/4''x2 5/8''	1/4''	2 5/8	1 5/8	100
KH-EZ C 1/4''x2''	1/4''	2	1 5/8	100
KH-EZ C 1/4''x2 1/2''	1/4''	2 1/2	1 5/8	100
KH-EZ C 1/4''x3''	1/4''	3	1 5/8	100
KH-EZ C 1/4''x4''	1/4''	4	1 5/8	100
KH-EZ 1/4''x1 7/8''	1/4''	1 7/8	1 5/8	100
KH-EZ 1/4''x2 5/8''	1/4''	2 5/8	1 5/8	100
KH-EZ 1/4''x3''	1/4''	3	1 5/8	100
KH-EZ 1/4''x3 1/2''	1/4''	3 1/2	1 5/8	100
KH-EZ 1/4''x4''	1/4''	4	1 5/8	100
KH-EZ 3/8''x1 7/8''	3/8''	1 7/8	1 5/8	50
KH-EZ 3/8''x2 1/8''	3/8''	2 1/8	1 5/8	50
KH-EZ (CRC) 3/8''x3''	3/8''	3	2 1/2	50
KH-EZ 3/8''x3 1/2''	3/8''	3 1/2	2 1/2	50
KH-EZ (CRC) 3/8''x4''	3/8''	4	3 1/4	50
KH-EZ (CRC) 3/8''x5''	3/8''	5	3 1/4	50
KH-EZ C 3/8''x2 1/2''	3/8''	2 1/2	1 5/8	50
KH-EZ C 3/8''x3''	3/8''	3	2 1/2	50
KH-EZ C 3/8''x4''	3/8''	4	2 1/2	50
KH-EZ 1/2''x2 1/2''	1/2''	2 1/2	2 1/4	25
KH-EZ (CRC) 1/2''x3''	1/2''	3	2 1/4	25
KH-EZ 1/2''x3 1/2''	1/2''	3 1/2	2 1/4	25
KH-EZ (CRC) 1/2''x4''	1/2''	4	2 1/4	25
KH-EZ 1/2''x4 1/2''	1/2''	4 1/2	3	25
KH-EZ (CRC) 1/2''x5''	1/2''	5	3	25
KH-EZ (CRC) 1/2''x6''	1/2''	6	3	25
KH-EZ 5/8''x3 1/2''	5/8''	3 1/2	3 1/4	15
KH-EZ 5/8''x4''	5/8''	4	3 1/4	15
KH-EZ (CRC) 5/8''x5 1/2''	5/8''	5 1/2	3 1/4	15
KH-EZ (CRC) 5/8''x6 1/2''	5/8''	6 1/2	3 1/4	15
KH-EZ (CRC) 5/8''x8''	5/8''	8	3 1/4	15
KH-EZ 3/4''x4 1/2''	3/4''	4 1/2	4	10
KH-EZ (CRC) 3/4''x5 1/2''	3/4''	5 1/2	4	10
KH-EZ (CRC) 3/4''x7''	3/4''	7	4	10
KH-EZ 3/4''x8''	3/4''	8	4	10
KH-EZ (CRC) 3/4''x9''	3/4''	9	4	10

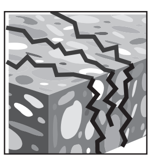
3.3.5 KWIK BOLT TZ2 EXPANSION ANCHOR

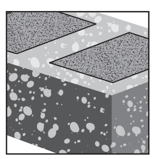
PRODUCT DESCRIPTION

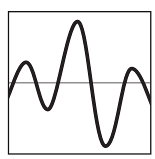
KWIK BOLT TZ2 Expansion anchor

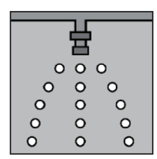
Anchor System	Features and Benefits
 Carbon steel KB-TZ2  Stainless Steel 304/316 KB-TZ2	• IFU provides multiple installation methods including no hole cleaning with hammer drill, Hilti Dust Removal System (DRS) for virtually dustless installation (OSHA 1926.1153 Table 1 compliant) and core drilling installation. • More accurate SafeSet™ installation when using the Hilti SIW-6AT-A22 impact wrench and the SI-AT-A22 Adaptive Torque Module. • Product and length identification marks help facilitate quality control after installation. • Maximized thread lengths and multiple embedment depths to accommodate various base plate thicknesses. • Mechanical expansion allows immediate load application. • Raised impact section (dog point) helps protect threads from damage during installation. • Bolt meets ductility requirements of ACI 318 Section 2.3. • Functional coatings and profile on expansion wedges provide increased reliability.


Uncracked concrete


Cracked concrete


Grout-filled concrete masonry


Seismic Design Categories A-F


Fire sprinkler listings

Profis Engineering design software

Hollow Drill Bit and Adaptive Torque Tool (AT)

Approvals/ Listings	
ICC-ES (International Code Council) • 2021 International Building Code / International Residential Code (IBC/IRC) • 2015 National Building Code of Canada (NBC-C)	ESR-4266 in concrete per ACI 318 Ch. 17 / ACI 355.2/ ICC-ES AC193 ESR-4561 in grout-filled CMU per ICC-ES AC01 ELC-4266 in concrete per CSA A23.3 / ACI 355.2
City of Los Angeles	2020 LABC Supplement (within ESR-4266 & ESR-4561)
Florida Building Code	2020 FBC Supplement with HVHZ (within ESR-4266 & ESR-4561)
FM (Factory Mutual) — Carbon steel KB-TZ2 only	Pipe hanger components for automatic sprinkler systems 3/8 (up to 4-inch nominal pipe diameter) 1/2[1] (up to 8-inch nominal pipe diameter) 3/4 (up to 12-inch nominal pipe diameter)
UL and cUL (Underwriters Laboratory) — Carbon steel KB-TZ2 only	Pipe hanger equipment for fire protection services 3/8 (up to 4-inch nominal pipe diameter) 1/2[1] (up to 8-inch nominal pipe diameter) 5/8 & 3/4 (up to 12-inch nominal pipe diameter)
ANSI/MSS SP-58-2018	Anchors conform to ANSI/MSSP-58-2018. Contact Hilti for more information.

1 1/2-inch dia. with 1-1/2-inch effective embedment does not have FM or UL certification.

APPROVED

LISTED

Pipe Hanger 757G

MATERIAL SPECIFICATIONS

Carbon steel with electroplated zinc-nickel plating

- Carbon steel anchor components plated in accordance with ASTM F1941 to a minimum thickness of 5 μm.
- Nuts conform to the requirements of ASTM A563, Grade A, Hex.
- Washers meet the requirements of ASTM F844.
- Expansion sleeves (wedges) are manufactured from carbon or stainless steel.
- Nuts and bolts are finished with a proprietary coating. Only Hilti KB-TZ2 nuts can be used with KB-TZ2 bolts.
- Carbon steel bolts are manufactured from carbon steel.

Stainless steel

- All nuts and washers for type 304 anchors are made from type 304 stainless.
- All nuts and washers for type 316 anchors are made from type 316 stainless.
- Nuts meet the dimensional requirements of ASTM F594.
- Washers meet the dimensional requirements of ANSI B18.22.1, Type A, plain.
- Expansion sleeve (wedges) are made from stainless steel.
- Nuts and bolts are finished with a proprietary coating. Only Hilti KB-TZ2 nuts can be used with KB-TZ2 bolts.
- Stainless steel 304 bolts are manufactured from AISI Type 304 stainless steel.
- Stainless steel 316 bolts are manufactured from AISI Type 316 stainless steel.

INSTALLATION PARAMETERS

Table 1 — Hilti KB-TZ2 setting information for installation in concrete and grout-filled concrete masonry units (CMU)[1]

	Setting information	Symbol	Units	Nominal anchor diameter (in)															
				1/4	3/8			1/2				5/8			3/4			1	
	Nominal bit diameter	d_o	in.	1/4	3/8			1/2				5/8			3/4			1	
	Effective minimum embedment	h_{ef}	in.	1-1/2	1-1/2	2	2-1/2	1-1/2 [2]	2	2-1/2	3-1/4	2-3/4	3-1/4	4	3-1/4	3-3/4	4-3/4	4	5-3/4
			(mm)	(38)	(38)	(51)	(64)	(38)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)	(102)	(146)
	Nominal minimum embedment	h_{nom}	in.	1-3/4	1-7/8	2-1/2	3	2 2)	2-1/2	3	3-3/4	3-1/4	3-3/4	4-1/2	4	4-1/2	5-1/2	4-5/8	6-3/8
			(mm)	(44)	(48)	(64)	(76)	(51)	(64)	(76)	(95)	(83)	(95)	(114)	(102)	(114)	(140)	(117)	(162)
	Min. hole depth	h_o	in.	2	2	2-3/4	3-1/4	2-1/4 [2]	2-3/4	3-1/4	4-1/4	3-3/4	4-1/4	4-3/4	4-1/4	4-3/4	5-3/4	5	6-3/4
			(mm)	(51)	(51)	(70)	(83)	(57)	(70)	(83)	(108)	(95)	(108)	(121)	(108)	(121)	(146)	(127)	(171)
	Fixture hole diameter	d_h	in.	5/16	7/16			9/16				11/16			13/16			1-1/8	
			(mm)	(7.9)	(11.1)			(14.3)				(17.5)			(20.6)			(28.6)	
Concrete	Installation torque Carbon steel	$T_{inst,conc}$	ft-lb	4	30			50				40			110			185	
			(Nm)	(5)	(41)			(68)				(54)			(149)			(251)	
	Installation torque Stainless steel	$T_{inst,conc}$	ft-lb	6	30			40				60			125			185	
			(Nm)	(8)	(41)			(54)				(81)			(169)			(251)	
Grout-filled CMU	Installation torque Carbon steel	$T_{inst,CMU}$	ft-lb	4	15			25				30			50			N/A	
			(Nm)	(5)	(20)			(34)				(41)			(68)			N/A	
	Installation torque Stainless steel	$T_{inst,CMU}$	ft-lb	6	15			25				35			50			N/A	
			(Nm)	(8)	(20)			(34)				(48)			(68)			N/A	

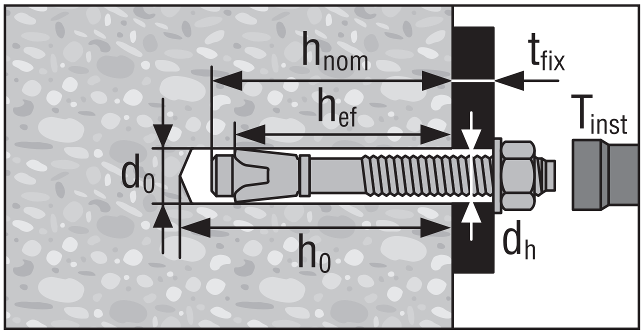
1 Shaded cells are not applicable for installations in grout-filled CMU.
2 Design information for h_{ef} = 1-1/2 is only applicable to carbon steel (CS) KB-TZ2 bolts.

Hilti KWIK Bolt TZ2 Fracture Load (lb)[1]

Nominal Anchor Diameter (in)	Carbon Steel	Stainless Steel
1/4	2920	2920
3/8	6490	6180
1/2	11240	11870
5/8	17535	18835
3/4	25335	$f_{uta} \geq 105$, $f_y \geq 84$ [2]
1	$f_{uta} \geq 88$, $f_y \geq 75$ [2]	$f_{uta} \geq 99.9$, $f_y \geq 65$ [2]

1 Bolt fracture loads are determined by testing in a universal tensile machine for quality control at the manufacturing facility. These loads are not intended for design use.
2 All 3/4-in. stainless steel, all 1-in. carbon steel and all 1-in. stainless steel material strengths specified by the tensile and yield strengths expressed in (ksi). Bolt fracture loads not applicable for these models.

Figure 1 — Hilti KWIK Bolt TZ 2 specifications



DESIGN INFORMATION IN CONCRETE PER ACI 318

ACI 318 Chapter 17 Design

The load values contained in this section are Hilti Simplified Design Tables. The load tables in this section were developed using the Strength Design parameters and variables of ICC-ES ESR-4266 and the equations within ACI 318 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables refer to section 3.1.8. Data tables from ESR-4266 are not contained in this section but can be found at www.icc-es.org or at www.hilti.com

Table 2 — Hilti Carbon Steel KB-TZ2 design strength based on concrete failure modes in uncracked concrete per ACI 318 Ch. 17, applicable for both hammer and core drilled installations [1,2,3,4]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension (lesser of concrete breakout / pullout) - ΦN_n				Shear (lesser of concrete breakout or pryout) - ΦV_n			
			f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)
1/4	1-1/2 (38)	1 3/4 (44)	945 (4.2)	980 (4.4)	1,040 (4.6)	1,125 (5.0)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
3/8	1-1/2 (38)	1 7/8 (48)	1,435 (6.4)	1,570 (7.0)	1,815 (8.1)	2,220 (9.9)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
	2 (51)	2 1/2 (64)	2,205 (9.8)	2,415 (10.7)	2,790 (12.4)	3,420 (15.2)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	2-1/2 (64)	3 (76)	2,715 (12.1)	2,895 (12.9)	3,205 (14.3)	3,690 (16.4)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
1/2	1-1/2 (38)	2 (51)	1,610 (7.2)	1,765 (7.9)	2,040 (9.1)	2,495 (11.1)	1,735 (7.7)	1,900 (8.5)	2,195 (9.8)	2,690 (12.0)
	2 (51)	2 1/2 (64)	2,480 (11.0)	2,720 (12.1)	3,140 (14.0)	3,845 (17.1)	2,675 (11.9)	2,930 (13.0)	3,380 (15.0)	4,140 (18.4)
	2-1/2 (64)	3 (76)	3,085 (13.7)	3,375 (15.0)	3,900 (17.3)	4,775 (21.2)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
	3-1/4 (83)	3 3/4 (95)	4,570 (20.3)	5,005 (22.3)	5,780 (25.7)	7,080 (31.5)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
5/8	2-3/4 (70)	3 1/4 (83)	3,495 (15.5)	3,830 (17.0)	4,425 (19.7)	5,420 (24.1)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)
	3-1/4 (83)	3 3/4 (95)	4,570 (20.3)	5,005 (22.3)	5,780 (25.7)	7,080 (31.5)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
	4 (102)	4 1/2 (114)	5,845 (26.0)	6,405 (28.5)	7,395 (32.9)	9,060 (40.3)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
3/4	3-1/4 (83)	4 (102)	5,140 (22.9)	5,630 (25.0)	6,505 (28.9)	7,965 (35.4)	11,075 (49.3)	12,130 (54.0)	14,005 (62.3)	17,155 (76.3)
	3-3/4[5] (95)	4 1/2 (114)	6,370 (28.3)	6,980 (31.0)	8,060 (35.9)	9,870 (43.9)	13,725 (61.1)	15,035 (66.9)	17,360 (77.2)	21,265 (94.6)
	4-3/4 (121)	5 1/2 (140)	8,075 (35.9)	8,845 (39.3)	10,215 (45.4)	12,510 (55.6)	17,390 (77.4)	19,050 (84.7)	22,000 (97.9)	26,945 (119.9)
1	4 (102)	4 5/8 (117)	7,020 (31.2)	7,690 (34.2)	8,880 (39.5)	10,875 (48.4)	15,120 (67.3)	16,565 (73.7)	19,125 (85.1)	23,425 (104.2)
	5-3/4 (146)	6 3/8 (162)	10,755 (47.8)	11,780 (52.4)	13,605 (60.5)	16,660 (74.1)	23,165 (103.0)	25,375 (112.9)	29,300 (130.3)	35,885 (159.6)

1 See Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 6 to 15 as necessary. Compare to the steel values in table 4. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60.
5 For core drilled installations of 3/4" anchors installed at 3-3/4" effective embedment, apply a reduction factor of 0.89 to the design tension strength.

Table 3 — Hilti Carbon Steel KB-TZ2 design strength based on concrete failure modes in cracked concrete per ACI 318 Ch. 17, applicable for both hammer and core drilled installations [1,2,3,4,5]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension (lesser of concrete breakout / pullout) - ΦN_n				Shear (lesser of concrete breakout or pryout) - ΦV_n			
			f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)
1/4	1-1/2 (38)	1 3/4 (44)	280 (1.2)	300 (1.3)	340 (1.5)	395 (1.8)	1,095 (4.9)	1,195 (5.3)	1,385 (6.2)	1,695 (7.5)
3/8	1-1/2 (38)	1 7/8 (48)	1,255 (5.6)	1,375 (6.1)	1,585 (7.1)	1,940 (8.6)	1,350 (6.0)	1,480 (6.6)	1,710 (7.6)	2,090 (9.3)
	2 (51)	2 1/2 (64)	1,930 (8.6)	2,115 (9.4)	2,440 (10.9)	2,990 (13.3)	2,080 (9.3)	2,275 (10.1)	2,630 (11.7)	3,220 (14.3)
	2-1/2 (64)	3 (76)	2,185 (9.7)	2,390 (10.6)	2,765 (12.3)	3,385 (15.1)	4,705 (20.9)	5,155 (22.9)	5,950 (26.5)	7,285 (32.4)
1/2	1-1/2 (38)	2 (51)	1,435 (6.4)	1,570 (7.0)	1,815 (8.1)	2,220 (9.9)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
	2 (51)	2 1/2 (64)	1,930 (8.6)	2,115 (9.4)	2,440 (10.9)	2,990 (13.3)	2,080 (9.3)	2,275 (10.1)	2,630 (11.7)	3,220 (14.3)
	2-1/2 (64)	3 (76)	2,700 (12.0)	2,955 (13.1)	3,415 (15.2)	4,180 (18.6)	5,810 (25.8)	6,365 (28.3)	7,350 (32.7)	9,000 (40.0)
	3-1/4 (83)	3 3/4 (95)	3,235 (14.4)	3,545 (15.8)	4,095 (18.2)	5,015 (22.3)	6,970 (31.0)	7,640 (34.0)	8,820 (39.2)	10,800 (48.0)
5/8	2-3/4 (70)	3 1/4 (83)	3,110 (13.8)	3,410 (15.2)	3,935 (17.5)	4,820 (21.4)	6,705 (29.8)	7,345 (32.7)	8,480 (37.7)	10,385 (46.2)
	3-1/4 (83)	3 3/4 (95)	4,000 (17.8)	4,380 (19.5)	5,060 (22.5)	6,195 (27.6)	8,615 (38.3)	9,435 (42.0)	10,895 (48.5)	13,345 (59.4)
	4 (102)	4 1/2 (114)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
3/4	3-1/4 (83)	4 (102)	4,000 (17.8)	4,380 (19.5)	5,060 (22.5)	6,195 (27.6)	8,615 (38.3)	9,435 (42.0)	10,895 (48.5)	13,345 (59.4)
	3-3/4 (95)	4 1/2 (114)	4,955 (22.0)	5,430 (24.2)	6,270 (27.9)	7,680 (34.2)	10,675 (47.5)	11,695 (52.0)	13,505 (60.1)	16,540 (73.6)
	4-3/4 (121)	5 1/2 (140)	5,745 (25.6)	6,055 (26.9)	6,580 (29.3)	7,405 (32.9)	15,220 (67.7)	16,670 (74.2)	19,250 (85.6)	23,575 (104.9)
1	4 (102)	4 5/8 (117)	5,460 (24.3)	5,980 (26.6)	6,905 (30.7)	8,460 (37.6)	11,760 (52.3)	12,880 (57.3)	14,875 (66.2)	18,220 (81.0)
	5-3/4 (146)	6 3/8 (162)	7,675 (34.1)	8,410 (37.4)	9,710 (43.2)	11,890 (52.9)	20,270 (90.2)	22,205 (98.8)	25,640 (114.1)	31,400 (139.7)

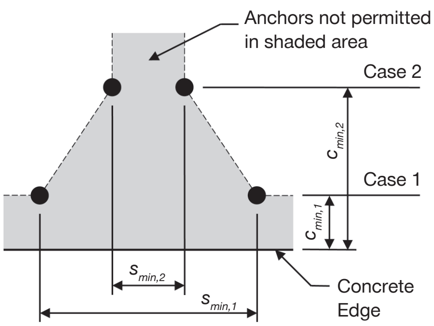
1 See Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 6 to 17 as necessary. Compare to the steel values in table 4. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis}$ = 0.75, except for 3/4 x 4-3/4 h_{ef} where $\alpha_{N,seis}$ = 0.73. No reduction needed for seismic shear. See Section 3.1.8 for additional information on seismic applications.

Table 4 — Hilti Carbon Steel KB-TZ2 design strength based on steel failure per ACI 318 Ch. 17 [1,2]

Nominal anchor diameter in.	Effective embedment depth in. (mm)			Tensile [3] ϕN_{sa} lb (kN)	Shear [4] ϕV_{sa} lb (kN)	Seismic Shear [5] ϕV_{sa} lb (kN)
1/4	1-1/2 (38)			2,190 (9.7)	875 (3.9)	875 (3.9)
3/8	1-1/2 (38)			4,870 (21.7)	2,095 (9.3)	2,095 (9.3)
3/8	2 (51)		2-1/2 (64)	4,870 (21.7)	2,200 (9.8)	2,200 (9.8)
1/2	1-1/2 (38)		2 (51)	8,430 (37.5)	3,600 (16.0)	3,600 (16.0)
1/2	2-1/2 (64)		3-1/4 (83)	8,430 (37.5)	4,470 (19.9)	4,470 (19.9)
5/8	2-3/4 (70)	3-1/4 (83)	4 (102)	13,150 (58.5)	6,665 (29.6)	6,665 (29.6)
3/4	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	19,000 (84.5)	8,975 (39.9)	8,975 (39.9)
1 (25.4)	4 (102)			31,025 (138.0)	12,215 (54.3)	8,975 (39.9)
1 (25.4)	5-3/4 (146)			31,025 (138.0)	14,875 (66.2)	8,975 (39.9)

1 See Section 3.1.8 to convert design strength value to ASD value.
2 Hilti KB-TZ2 carbon steel anchors are to be considered ductile steel elements.
3 Tensile $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Ch. 17.
4 Shear values determined by static shear tests with $\phi V_{sa} < \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
5 Seismic shear values determined by seismic shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17. See Section 3.1.8 for additional information on seismic applications.

Figure 2



For a specific edge distance, the permitted spacing is calculated as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})}(c - c_{min,2})$$

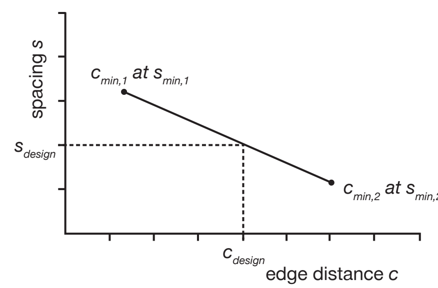


Table 5 — Hilti KB-TZ2 carbon steel installation parameters [1]

Setting information	Symbol	Units	Nominal Anchor diameter (in.)																
			1/4	3/8			1/2				5/8			3/4			1	
Effective embedment	h_{ef}	in.	1-1/2	1-1/2	2	2-1/2	1-1/2	2	2-1/2	3 1/4	2-3/4	3-1/4	4	3-1/4	3-3/4	4-3/4	4	5-3/4
		(mm)	(38)	(38)	(51)	(64)	(38)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)	(102)	(146)
Min. member thickness	h_{min}	in.	3-1/4	3-1/4	4	5	3-1/2	4	5	5-1/2	5	5-1/2	6	5-1/2	6	8	8	10
		(mm)	(83)	(83)	(102)	(127)	(89)	(102)	(127)	(140)	(127)	(140)	(152)	(140)	(152)	(203)	(203)	(254)
Case 1	$c_{min,1}$	in.	1-1/2	5	2-1/2	2-1/2	8	2-3/4	2-3/4	2-1/4	4-1/2	3-1/2	2-3/4	5	4	3-1/2	8	3
		(mm)	(38)	(127)	(64)	(64)	(203)	(70)	(70)	(57)	(114)	(89)	(70)	(127)	(102)	(89)	(203)	(76)
	for $s_{min,1} \geq$	in.	1-1/2	8	6	5	12	5-1/2	9-3/4	5-1/4	6-1/2	5-1/2	7-1/4	10	5-3/4	5-1/2	8	6-3/4
		(mm)	(38)	(203)	(152)	(127)	(305)	(140)	(248)	(133)	(165)	(140)	(184)	(254)	(146)	(140)	(203)	(171)
Case 2	$c_{min,2}$	in.	1-1/2	8	3-1/2	4	8	10	8	4-3/4	5-1/2	7	4-1/4	6	7-1/4	4-3/4	8	3-3/4
		(mm)	(38)	(203)	(89)	(102)	(203)	(254)	(203)	(121)	(140)	(178)	(108)	(152)	(184)	(121)	(203)	(95)
	for $s_{min,2} \geq$	in.	1-1/2	5	2-1/4	2	12	3-1/2	3	2	4-1/2	2-3/4	2-1/4	4-1/2	3-3/4	3-3/4	8	4-3/4
			(38)	(127)	(57)	(51)	(305)	(89)	(76)	(51)	(114)	(70)	(57)	(114)	(95)	(95)	(203)	(121)

1 Linear interpolation is permitted to establish an edge distance and spacing combination between Case 1 and Case 2. Linear interpolation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$, will determine the permissible spacings.

Table 6 — Load adjustment factors for Carbon Steel 1/4-in. diameter KB-TZ2 in uncracked concrete [1,2]

1/4-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear [3] f_{AV}	⊥ Toward edge f_{RV}	‖ To edge f_{RV}	Concrete thickness factor in shear [4] f_{HV}
Effective Embedment h_{ef}		in. (mm)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)
Nominal Embedment h_{nom}		in. (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	1-1/2	(38)	0.67	0.42	0.56	0.23	0.42	n/a
	2	(51)	0.72	0.51	0.58	0.35	0.51	n/a
	2-1/2	(64)	0.78	0.63	0.60	0.49	0.63	n/a
	3	(76)	0.83	0.75	0.63	0.65	0.75	n/a
	3-1/4	(83)	0.86	0.81	0.64	0.73	0.81	0.74
	3-1/2	(89)	0.89	0.88	0.65	0.82	0.88	0.76
	4	(102)	0.94	1.00	0.67	1.00	1.00	0.82
	5	(127)	1.00		0.71			0.91
	6	(152)			0.75			1.00
	7	(178)			0.79			
	8	(203)			0.83			
	9	(229)			0.88			
	> 12	(305)			1.00			

3.3.5

Table 7 — Load adjustment factors for Carbon Steel 1/4-in. diameter KB-TZ2 in cracked concrete [1,2]

1/4-in. KB-TZ2 cracked concrete			Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear [3] f_{AV}	⊥ Toward edge f_{RV}	‖ To edge f_{RV}	Concrete thickness factor in shear [4] f_{HV}
Effective Embedment h_e		in. (mm)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)
Nominal Embedment h_{nom}		in. (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	1-1/2	(38)	0.67	0.75	0.57	0.29	0.59	n/a
	2	(51)	0.72	0.91	0.60	0.45	0.91	n/a
	2-1/2	(64)	0.78	1.00	0.62	0.63	1.00	n/a
	3	(76)	0.83		0.65	0.83		n/a
	3-1/4	(83)	0.86		0.66	0.94		0.80
	3-1/2	(89)	0.89		0.67	1.00		0.83
	4	(102)	0.94		0.70			0.89
	5	(127)	1.00		0.75			0.99
	6	(152)			0.80			1.00
	7	(178)			0.84			
	8	(203)			0.89			
	9	(229)			0.94			
	> 12	(305)			1.00			

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative.
To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

Table 8 — Load adjustment factors for Carbon Steel 3/8-in. diameter KB-TZ2 in uncracked concrete [1,2]

3/8-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}		in. (mm)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)
Nominal Embedment h_{nom}		in. (mm)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	2	(51)	n/a	n/a	0.63	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/4	(57)	n/a	0.69	0.65	n/a	n/a	n/a	n/a	0.59	0.55	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/2	(64)	n/a	0.71	0.67	n/a	0.60	0.51	n/a	0.60	0.55	n/a	0.43	0.18	n/a	0.60	0.37	n/a	n/a	n/a
	3	(76)	n/a	0.75	0.70	n/a	0.69	0.58	n/a	0.61	0.56	n/a	0.57	0.24	n/a	0.69	0.48	n/a	n/a	n/a
	3-1/4	(83)	n/a	0.77	0.72	n/a	0.74	0.61	n/a	0.62	0.57	n/a	0.64	0.27	n/a	0.74	0.54	0.66	n/a	n/a
	3-1/2	(89)	n/a	0.79	0.73	n/a	0.80	0.65	n/a	0.63	0.58	n/a	0.72	0.30	n/a	0.80	0.61	0.68	n/a	n/a
	4	(102)	n/a	0.83	0.77	n/a	0.91	0.73	n/a	0.65	0.59	n/a	0.87	0.37	n/a	0.91	0.73	0.73	0.78	n/a
	5	(127)	1.00	0.92	0.83	1.00	1.00	0.91	0.67	0.69	0.61	1.00	1.00	0.52	1.00	1.00	0.91	0.82	0.87	0.66
	6	(152)	1.00	1.00	0.90	1.00		1.00	0.70	0.73	0.63	1.00		0.68	1.00		1.00	0.89	0.96	0.72
	8	(203)	1.00		1.00	1.00			0.77	0.80	0.67	1.00		1.00	1.00			1.00	1.00	0.83
	12	(305)							0.90	0.96	0.76									1.00
	18	(457)							1.00	1.00	0.89									
	> 24	(610)									1.00									

Table 9 — Load adjustment factors for Carbon Steel 3/8-in. diameter KB-TZ2 in cracked concrete [1,2]

3/8-in. KB-TZ2 cracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}		in. (mm)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)
Nominal Embedment h_{nom}		in. (mm)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	2	(51)	n/a	n/a	0.63	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/4	(57)	n/a	0.69	0.65	n/a	n/a	n/a	n/a	0.58	0.55	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/2	(64)	n/a	0.71	0.67	n/a	0.87	0.75	n/a	0.59	0.55	n/a	0.40	0.18	n/a	0.80	0.37	n/a	n/a	n/a
	3	(76)	n/a	0.75	0.70	n/a	1.00	0.85	n/a	0.61	0.56	n/a	0.52	0.24	n/a	1.00	0.48	n/a	n/a	n/a
	3-1/4	(83)	n/a	0.77	0.72	n/a	1.00	0.90	n/a	0.62	0.57	n/a	0.59	0.27	n/a	1.00	0.55	0.78	n/a	n/a
	3-1/2	(89)	n/a	0.79	0.73	n/a	1.00	0.95	n/a	0.63	0.58	n/a	0.66	0.31	n/a	1.00	0.61	0.81	n/a	n/a
	4	(102)	n/a	0.83	0.77	n/a		1.00	n/a	0.64	0.59	n/a	0.81	0.37	n/a		0.75	0.86	0.76	n/a
	5	(127)	1.00	0.92	0.83	1.00			0.73	0.68	0.61	1.00	1.00	0.52	1.00		1.00	0.96	0.85	0.66
	6	(152)	1.00	1.00	0.90	1.00			0.78	0.72	0.63	1.00		0.69	1.00			1.00	0.93	0.72
	8	(203)	1.00		1.00	1.00			0.87	0.79	0.67	1.00		1.00	1.00				1.00	0.83
	12	(305)							1.00	0.93	0.76									1.00
	18	(457)								1.00	0.89									
	> 24	(610)									1.00									

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 2 and Table 5 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 10 — Load adjustment factors for Carbon Steel 1/2-in. diameter KB-TZ2 in uncracked concrete [1,2]

1/2-in. KB-TZ2 uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear [3] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear [4] f_{HV}			
Effective Embedment h_{ef}	in.	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4
	(mm)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)
Nominal Embedment h_{nom}	in.	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4
	(mm)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)																									
2	(51)	n/a	n/a	n/a	0.60	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.53	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2-1/4	(57)	n/a	n/a	n/a	0.62	n/a	n/a	n/a	0.30	n/a	n/a	n/a	0.54	n/a	n/a	n/a	0.11	n/a	n/a	n/a	0.21	n/a	n/a	n/a	n/a
2-3/4	(70)	n/a	n/a	n/a	0.64	n/a	0.51	0.44	0.33	n/a	n/a	n/a	0.55	n/a	0.35	0.23	0.14	n/a	0.51	0.44	0.29	n/a	n/a	n/a	n/a
3	(76)	n/a	n/a	0.70	0.65	n/a	0.55	0.47	0.35	n/a	n/a	0.57	0.55	n/a	0.40	0.26	0.16	n/a	0.55	0.47	0.33	n/a	n/a	n/a	n/a
3-1/4	(83)	n/a	n/a	0.72	0.67	n/a	0.59	0.50	0.37	n/a	n/a	0.57	0.55	n/a	0.45	0.30	0.19	n/a	0.59	0.50	0.37	0.52	n/a	n/a	n/a
3-1/2	(89)	n/a	0.79	0.73	0.68	n/a	0.64	0.53	0.38	n/a	0.61	0.58	0.56	n/a	0.51	0.33	0.21	n/a	0.64	0.53	0.38	0.54	n/a	n/a	n/a
4	(102)	n/a	0.83	0.77	0.71	n/a	0.73	0.59	0.42	n/a	0.62	0.59	0.57	n/a	0.62	0.40	0.25	n/a	0.73	0.59	0.42	0.58	0.70	n/a	n/a
4-3/4	(121)	n/a	0.90	0.82	0.74	n/a	0.86	0.70	0.48	n/a	0.64	0.61	0.58	n/a	0.80	0.52	0.33	n/a	0.86	0.70	0.48	0.63	0.76	n/a	n/a
5	(127)	n/a	0.92	0.83	0.76	n/a	0.91	0.74	0.50	n/a	0.65	0.61	0.58	n/a	0.87	0.56	0.35	n/a	0.91	0.74	0.50	0.65	0.78	0.67	n/a
5-1/4	(133)	n/a	0.94	0.85	0.77	n/a	0.95	0.78	0.53	n/a	0.66	0.62	0.59	n/a	0.93	0.61	0.38	n/a	0.95	0.78	0.53	0.66	0.80	0.69	n/a
5-1/2	(140)	n/a	0.96	0.87	0.78	n/a	1.00	0.81	0.55	n/a	0.67	0.63	0.59	n/a	1.00	0.65	0.41	n/a	1.00	0.81	0.55	0.68	0.82	0.71	0.61
6	(152)	n/a	1.00	0.90	0.81	n/a	1.00	0.89	0.60	n/a	0.68	0.64	0.60	n/a	1.00	0.74	0.46	n/a	1.00	0.89	0.60	0.71	0.85	0.74	0.63
8	(203)	n/a		1.00	0.91	1.00	1.00	1.00	0.80	n/a	0.74	0.68	0.63	1.00	1.00	1.00	0.72	1.00	1.00	1.00	0.80	0.82	0.98	0.85	0.73
9-3/4	(248)	n/a		1.00	1.00		1.00		0.98	n/a	0.80	0.72	0.66		1.00		0.96		1.00		0.98	0.90	1.00	0.94	0.81
10	(254)	n/a					1.00		1.00	n/a	0.80	0.73	0.67		1.00		1.00		1.00		1.00	0.91		0.95	0.82
12	(305)	1.00								0.75	0.86	0.77	0.70									1.00		1.00	0.89
24	(610)									1.00	1.00	1.00	0.90												1.00
> 30	(762)												1.00												

3.3.5

Table 11 — Load adjustment factors for Carbon Steel 1/2-in. diameter KB-TZ2 in cracked concrete [1,2]

1/2-in. KB-TZ2 cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear [3] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear [4] f_{HV}			
Effective Embedment h_{ef}	in.	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4	1-1/2	2	2-1/2	3-1/4
	(mm)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)	(38)	(51)	(64)	(83)
Nominal Embedment h_{nom}	in.	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4	2	2-1/2	3	3-3/4
	(mm)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)	(51)	(64)	(76)	(95)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)																									
2	(51)	n/a	n/a	n/a	0.60	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2-1/4	(57)	n/a	n/a	n/a	0.62	n/a	n/a	n/a	0.61	n/a	n/a	n/a	0.54	n/a	n/a	n/a	0.12	n/a	n/a	n/a	0.24	n/a	n/a	n/a	n/a
2-3/4	(70)	n/a	n/a	n/a	0.64	n/a	0.93	0.80	0.68	n/a	n/a	n/a	0.55	n/a	0.50	0.19	0.16	n/a	0.93	0.38	0.33	n/a	n/a	n/a	n/a
3	(76)	n/a	n/a	0.70	0.65	n/a	1.00	0.85	0.71	n/a	n/a	0.56	0.55	n/a	0.57	0.21	0.19	n/a	1.00	0.43	0.38	n/a	n/a	n/a	n/a
3-1/4	(83)	n/a	n/a	0.72	0.67	n/a	1.00	0.90	0.75	n/a	n/a	0.56	0.56	n/a	0.64	0.24	0.21	n/a	1.00	0.48	0.42	0.76	n/a	n/a	n/a
3-1/2	(89)	n/a	0.79	0.73	0.68	n/a	1.00	0.95	0.79	n/a	0.63	0.57	0.56	n/a	0.72	0.27	0.24	n/a	1.00	0.54	0.47	0.79	n/a	n/a	n/a
4	(102)	n/a	0.83	0.77	0.71	n/a	1.00	1.00	0.86	n/a	0.65	0.58	0.57	n/a	0.88	0.33	0.29	n/a	1.00	0.66	0.58	0.85	0.78	n/a	n/a
4-3/4	(121)	n/a	0.90	0.82	0.74	n/a	1.00	1.00	0.98	n/a	0.68	0.59	0.59	n/a	1.00	0.43	0.37	n/a	1.00	0.85	0.75	0.92	0.85	n/a	n/a
5	(127)	n/a	0.92	0.83	0.76	n/a	1.00	1.00	1.00	n/a	0.69	0.60	0.59	n/a	1.00	0.46	0.40	n/a	1.00	0.92	0.81	0.95	0.87	0.63	n/a
5-1/4	(133)	n/a	0.94	0.85	0.77	n/a	1.00	1.00		n/a	0.70	0.60	0.60	n/a	1.00	0.49	0.43	n/a	1.00	0.99	0.87	0.97	0.90	0.65	n/a
5-1/2	(140)	n/a	0.96	0.87	0.78	n/a	1.00	1.00		n/a	0.71	0.61	0.60	n/a	1.00	0.53	0.47	n/a	1.00	1.00	0.93	0.99	0.92	0.66	0.63
6	(152)	n/a	1.00	0.90	0.81	n/a	1.00	1.00		n/a	0.73	0.62	0.61	n/a	1.00	0.60	0.53	n/a	1.00	1.00	1.00	1.00	0.96	0.69	0.66
8	(203)	n/a		1.00	0.91	1.00	1.00	1.00		n/a	0.81	0.66	0.65	1.00	1.00	0.93	0.82	1.00	1.00	1.00			1.00	0.80	0.76
9-3/4	(248)	n/a		1.00	1.00		1.00			n/a	0.87	0.69	0.68		1.00	1.00	1.00		1.00					0.88	0.84
10	(254)	n/a					1.00			n/a	0.88	0.70	0.68		1.00				1.00					0.89	0.85
12	(305)	1.00								1.00	0.96	0.74	0.72											0.98	0.94
24	(610)										1.00	0.98	0.94											1.00	1.00
> 30	(762)											1.00	1.00												

1 Linear interpolation not permitted

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.

3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 2 and Table 5 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 12 — Load adjustment factors for Carbon Steel 5/8-in. diameter KB-TZ2 in uncracked concrete [1,2]

5/8-in. KB-TZ2 uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ‖ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in. (mm)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)
Nominal Embedment h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm) 2-1/4	(57)	n/a	0.62	n/a	n/a	n/a	0.38	n/a	0.53	n/a	n/a	n/a	0.10	n/a	n/a	0.20	n/a	n/a	n/a
2-3/4	(70)	n/a	0.64	0.61	n/a	n/a	0.42	n/a	0.54	0.54	n/a	n/a	0.13	n/a	n/a	0.27	n/a	n/a	n/a
3	(76)	n/a	0.65	0.63	n/a	0.30	0.44	n/a	0.54	0.55	n/a	0.13	0.15	n/a	0.27	0.30	n/a	n/a	n/a
3-1/2	(89)	n/a	0.68	0.65	n/a	0.33	0.48	n/a	0.55	0.56	n/a	0.17	0.19	n/a	0.33	0.38	n/a	n/a	n/a
4	(102)	0.74	0.71	0.67	0.40	0.37	0.51	0.57	0.56	0.56	0.25	0.21	0.23	0.40	0.37	0.47	n/a	n/a	n/a
4-1/2	(114)	0.77	0.73	0.69	0.45	0.40	0.56	0.58	0.57	0.57	0.30	0.24	0.28	0.45	0.40	0.56	n/a	n/a	n/a
5	(127)	0.80	0.76	0.71	0.50	0.43	0.60	0.58	0.57	0.58	0.35	0.29	0.33	0.50	0.43	0.60	0.58	n/a	n/a
5-1/2	(140)	0.83	0.78	0.73	0.55	0.48	0.64	0.59	0.58	0.59	0.41	0.33	0.38	0.55	0.48	0.64	0.61	0.56	n/a
6	(152)	0.86	0.81	0.75	0.60	0.52	0.69	0.60	0.59	0.59	0.46	0.38	0.43	0.60	0.52	0.69	0.63	0.59	0.62
6-1/2	(165)	0.89	0.83	0.77	0.65	0.57	0.74	0.61	0.59	0.60	0.52	0.42	0.48	0.65	0.57	0.74	0.66	0.61	0.64
7	(178)	0.92	0.86	0.79	0.70	0.61	0.80	0.62	0.60	0.61	0.59	0.47	0.54	0.70	0.61	0.80	0.68	0.64	0.67
7-1/4	(184)	0.94	0.87	0.80	0.73	0.63	0.83	0.62	0.61	0.61	0.62	0.50	0.57	0.73	0.63	0.83	0.70	0.65	0.68
12	(305)	1.00	1.00	1.00	1.00	1.00	1.00	0.70	0.67	0.69	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.83	0.87
24	(610)							0.90	0.85	0.88							1.00	1.00	1.00
> 36	(914)							1.00	1.00	1.00									

Table 13 — Load adjustment factors for Carbon Steel 5/8-in. diameter KB-TZ2 in cracked concrete [1,2]

5/8-in. KB-TZ2 cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ‖ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in. (mm)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)
Nominal Embedment h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm) 2-1/4	(57)	n/a	0.62	n/a	n/a	n/a	0.56	n/a	0.54	n/a	n/a	n/a	0.10	n/a	n/a	0.20	n/a	n/a	n/a
2-3/4	(70)	n/a	0.64	0.61	n/a	n/a	0.61	n/a	0.55	0.54	n/a	n/a	0.13	n/a	n/a	0.27	n/a	n/a	n/a
3	(76)	n/a	0.65	0.63	n/a	0.71	0.64	n/a	0.55	0.55	n/a	0.16	0.15	n/a	0.32	0.31	n/a	n/a	n/a
3-1/2	(89)	n/a	0.68	0.65	n/a	0.79	0.69	n/a	0.56	0.56	n/a	0.20	0.19	n/a	0.41	0.39	n/a	n/a	n/a
4	(102)	0.74	0.71	0.67	0.98	0.86	0.75	0.58	0.57	0.56	0.31	0.25	0.24	0.62	0.50	0.47	n/a	n/a	n/a
4-1/2	(114)	0.77	0.73	0.69	1.00	0.94	0.81	0.59	0.57	0.57	0.37	0.30	0.28	0.74	0.60	0.56	n/a	n/a	n/a
5	(127)	0.80	0.76	0.71	1.00	1.00	0.87	0.60	0.58	0.58	0.43	0.35	0.33	0.87	0.70	0.66	0.62	n/a	n/a
5-1/2	(140)	0.83	0.78	0.73	1.00	1.00	0.93	0.61	0.59	0.59	0.50	0.40	0.38	1.00	0.81	0.76	0.65	0.60	n/a
6	(152)	0.86	0.81	0.75		1.00	1.00	0.61	0.60	0.60	0.57	0.46	0.43		0.92	0.87	0.68	0.63	0.62
6-1/2	(165)	0.89	0.83	0.77		1.00		0.62	0.61	0.60	0.64	0.52	0.49		1.00	0.98	0.71	0.66	0.64
7	(178)	0.92	0.86	0.79		1.00		0.63	0.62	0.61	0.72	0.58	0.55		1.00	1.00	0.73	0.68	0.67
7-1/4	(184)	0.94	0.87	0.80				0.64	0.62	0.62	0.76	0.61	0.58				0.74	0.69	0.68
12	(305)	1.00	1.00	1.00				0.73	0.70	0.69	1.00	1.00	1.00				0.96	0.89	0.87
24	(610)							0.96	0.90	0.88							1.00	1.00	1.00
> 36	(914)							1.00	1.00	1.00									

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 2 and Table 5 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 14 — Load adjustment factors for Carbon Steel 3/4-in. diameter KB-TZ2 in uncracked concrete [1,2]

3/4-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in.		3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4
	(mm)		(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)
Nominal Embedment h_{nom}	in.		4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2
	(mm)		(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	3-1/2	(89)	n/a	n/a	n/a	n/a	n/a	0.50	n/a	n/a	n/a	n/a	n/a	0.16	n/a	n/a	0.32	n/a	n/a	n/a
	3-3/4	(95)	n/a	0.67	0.63	n/a	n/a	0.52	n/a	0.56	0.55	n/a	n/a	0.18	n/a	n/a	0.36	n/a	n/a	n/a
	4	(102)	n/a	0.68	0.64	n/a	0.44	0.54	n/a	0.56	0.56	n/a	0.24	0.20	n/a	0.44	0.40	n/a	n/a	n/a
	4-1/2	(114)	0.73	0.70	0.66	n/a	0.48	0.57	0.56	0.57	0.56	n/a	0.29	0.24	n/a	0.48	0.47	n/a	n/a	n/a
	4-3/4	(121)	0.74	0.71	0.67	n/a	0.49	0.59	0.57	0.58	0.57	n/a	0.31	0.26	n/a	0.49	0.51	n/a	n/a	n/a
	5	(127)	0.76	0.72	0.68	0.42	0.51	0.61	0.57	0.58	0.57	0.27	0.33	0.28	0.42	0.51	0.55	n/a	n/a	n/a
	5-1/2	(140)	0.78	0.74	0.69	0.46	0.55	0.65	0.58	0.59	0.58	0.31	0.39	0.32	0.46	0.55	0.64	0.55	n/a	n/a
	5-3/4	(146)	0.79	0.76	0.70	0.48	0.58	0.67	0.58	0.59	0.58	0.33	0.41	0.34	0.48	0.58	0.67	0.57	n/a	n/a
	6	(152)	0.81	0.77	0.71	0.50	0.60	0.69	0.58	0.60	0.58	0.35	0.44	0.36	0.50	0.60	0.69	0.58	0.62	n/a
	7	(178)	0.86	0.81	0.75	0.58	0.70	0.78	0.60	0.61	0.60	0.45	0.55	0.46	0.58	0.70	0.78	0.62	0.67	n/a
	7-1/4	(184)	0.87	0.82	0.75	0.60	0.73	0.81	0.60	0.62	0.60	0.47	0.58	0.48	0.60	0.73	0.81	0.63	0.68	n/a
	8	(203)	0.91	0.86	0.78	0.67	0.80	0.89	0.61	0.63	0.61	0.54	0.68	0.56	0.67	0.80	0.89	0.67	0.72	0.67
	9	(229)	0.96	0.90	0.82	0.75	0.90	1.00	0.63	0.64	0.63	0.65	0.81	0.67	0.75	0.90	1.00	0.71	0.76	0.71
	10	(254)	1.00	0.94	0.85	0.83	1.00		0.64	0.66	0.64	0.76	0.94	0.78	0.83	1.00		0.75	0.80	0.75
	11	(279)		0.99	0.89	0.92			0.65	0.68	0.66	0.88	1.00	0.90	0.92			0.78	0.84	0.79
	12	(305)		1.00	0.92	1.00			0.67	0.69	0.67	1.00		1.00	1.00			0.82	0.88	0.82
	16	(406)			1.00				0.72	0.76	0.73							0.94	1.00	0.95
	18	(457)							0.75	0.79	0.75							1.00		1.00
	24	(610)							0.83	0.89	0.84									
	> 36	(914)							1.00	1.00	1.00									

3.3.5

Table 15 — Load adjustment factors for Carbon Steel 3/4-in. diameter KB-TZ2 in cracked concrete [1,2]

3/4-in. KB-TZ2 cracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in.		3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4
	(mm)		(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)
Nominal Embedment h_{nom}	in.		4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2
	(mm)		(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	3-1/2	(89)	n/a	n/a	n/a	n/a	n/a	0.63	n/a	n/a	n/a	n/a	n/a	0.13	n/a	n/a	0.26	n/a	n/a	n/a
	3-3/4	(95)	n/a	0.67	0.63	n/a	n/a	0.65	n/a	0.56	0.55	n/a	n/a	0.15	n/a	n/a	0.29	n/a	n/a	n/a
	4	(102)	n/a	0.68	0.64	n/a	0.78	0.68	n/a	0.56	0.55	n/a	0.22	0.16	n/a	0.44	0.32	n/a	n/a	n/a
	4-1/2	(114)	0.73	0.70	0.66	n/a	0.85	0.73	0.58	0.57	0.56	n/a	0.26	0.19	n/a	0.52	0.39	n/a	n/a	n/a
	4-3/4	(121)	0.74	0.71	0.67	n/a	0.88	0.75	0.58	0.57	0.56	n/a	0.28	0.21	n/a	0.57	0.42	n/a	n/a	n/a
	5	(127)	0.76	0.72	0.68	1.00	0.91	0.77	0.59	0.58	0.56	0.37	0.31	0.23	0.74	0.61	0.45	n/a	n/a	n/a
	5-1/2	(140)	0.78	0.74	0.69	1.00	0.98	0.83	0.59	0.58	0.57	0.43	0.35	0.26	0.85	0.71	0.52	0.61	n/a	n/a
	5-3/4	(146)	0.79	0.76	0.70	1.00	1.00	0.85	0.60	0.59	0.57	0.46	0.38	0.28	0.91	0.76	0.56	0.63	n/a	n/a
	6	(152)	0.81	0.77	0.71	1.00	1.00	0.88	0.60	0.59	0.57	0.49	0.40	0.30	0.97	0.81	0.59	0.64	0.60	n/a
	7	(178)	0.86	0.81	0.75		1.00	0.99	0.62	0.61	0.59	0.61	0.51	0.37	1.00	1.00	0.75	0.69	0.65	n/a
	7-1/4	(184)	0.87	0.82	0.75			1.00	0.62	0.61	0.59	0.64	0.54	0.39	1.00	1.00	0.79	0.71	0.66	n/a
	8	(203)	0.91	0.86	0.78				0.64	0.62	0.60	0.75	0.62	0.46			0.91	0.74	0.70	0.63
	9	(229)	0.96	0.90	0.82				0.65	0.64	0.61	0.89	0.74	0.54			1.00	0.79	0.74	0.67
	10	(254)	1.00	0.94	0.85				0.67	0.65	0.62	1.00	0.87	0.64				0.83	0.78	0.70
	11	(279)		0.99	0.89				0.69	0.67	0.64		1.00	0.74				0.87	0.82	0.74
	12	(305)		1.00	0.92				0.71	0.68	0.65			0.84				0.91	0.85	0.77
	16	(406)			1.00				0.77	0.74	0.70			1.00				1.00	0.98	0.89
	18	(457)							0.81	0.77	0.72								1.00	0.94
	24	(610)							0.91	0.86	0.80									1.00
	> 36	(914)							1.00	1.00	0.94									

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 2 and Table 5 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 16 — Load adjustment factors for Carbon Steel 1-in. diameter KB-TZ2 in uncracked concrete [1,2]

1-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear [3] f_{AV}		Edge distance in shear ⊥ Toward edge f_{RV}		Edge distance in shear ∥ To edge f_{RV}		Concrete thickness factor in shear [4] f_{HV}	
Effective Embedment h_{ef}		in. (mm)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)
Nominal Embedment h_{nom}		in. (mm)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	3	(76)	n/a	n/a	n/a	0.292	n/a	n/a	n/a	0.081	n/a	0.162	n/a	n/a
	3-3/4	(95)	n/a	n/a	n/a	0.321	n/a	n/a	n/a	0.113	n/a	0.227	n/a	n/a
	4	(102)	n/a	n/a	n/a	0.331	n/a	n/a	n/a	0.125	n/a	0.250	n/a	n/a
	4-1/4	(108)	n/a	n/a	n/a	0.341	n/a	n/a	n/a	0.137	n/a	0.274	n/a	n/a
	4-3/4	(121)	n/a	0.638	n/a	0.362	n/a	0.549	n/a	0.162	n/a	0.324	n/a	n/a
	5	(127)	n/a	0.645	n/a	0.372	n/a	0.552	n/a	0.175	n/a	0.349	n/a	n/a
	6	(152)	n/a	0.674	n/a	0.415	n/a	0.563	n/a	0.230	n/a	0.415	n/a	n/a
	6-3/4	(171)	n/a	0.696	n/a	0.449	n/a	0.570	n/a	0.274	n/a	0.449	n/a	n/a
	8	(203)	0.833	0.732	0.727	0.508	0.621	0.583	0.620	0.354	0.727	0.508	0.696	n/a
	10	(254)	0.917	0.790	0.909	0.625	0.652	0.604	0.867	0.494	0.909	0.625	0.778	0.645
	12	(305)	1.000	0.848	1.000	0.750	0.682	0.625	1.000	0.650	1.000	0.750	0.853	0.707
	18	(457)		1.000		1.000	0.773	0.688		1.000		1.000	1.000	0.866
	24	(610)					0.864	0.750						1.000
	36	(914)					1.000	0.875						
	> 48	(1219)						1.000						

Table 17 — Load adjustment factors for Carbon Steel 1-in. diameter KB-TZ2 in cracked concrete [1,2]

1-in. KB-TZ2 cracked concrete			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear [3] f_{AV}		Edge distance in shear ⊥ Toward edge f_{RV}		Edge distance in shear ∥ To edge f_{RV}		Concrete thickness factor in shear [4] f_{HV}	
Effective Embedment h_{ef}		in. (mm)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)	4 (102)	5-3/4 (146)
Nominal Embedment h_{nom}		in. (mm)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	3	(76)	n/a	n/a	n/a	0.542	n/a	n/a	n/a	0.081	n/a	0.162	n/a	n/a
	3-3/4	(95)	n/a	n/a	n/a	0.596	n/a	n/a	n/a	0.113	n/a	0.226	n/a	n/a
	4	(102)	n/a	n/a	n/a	0.614	n/a	n/a	n/a	0.124	n/a	0.249	n/a	n/a
	4-1/4	(108)	n/a	n/a	n/a	0.633	n/a	n/a	n/a	0.136	n/a	0.272	n/a	n/a
	4-3/4	(121)	n/a	0.638	n/a	0.671	n/a	0.549	n/a	0.161	n/a	0.322	n/a	n/a
	5	(127)	n/a	0.645	n/a	0.690	n/a	0.552	n/a	0.174	n/a	0.348	n/a	n/a
	6	(152)	n/a	0.674	n/a	0.770	n/a	0.562	n/a	0.228	n/a	0.457	n/a	n/a
	6-3/4	(171)	n/a	0.696	n/a	0.833	n/a	0.570	n/a	0.273	n/a	0.545	n/a	n/a
	8	(203)	0.833	0.732	1.000	0.943	0.619	0.583	0.606	0.352	1.000	0.703	0.691	n/a
	10	(254)	0.917	0.790		1.000	0.649	0.604	0.847	0.491		0.983	0.773	0.644
	12	(305)	1.000	0.848			0.679	0.625	1.000	0.646		1.000	0.846	0.706
	18	(457)		1.000			0.769	0.687		1.000			1.000	0.864
	24	(610)					0.858	0.749						0.998
	36	(914)					1.000	0.874						1.000
	> 48	(1219)						0.998						

1 Linear interpolation not permitted

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.

3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 2 and Table 5 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 18 — Hilti Stainless Steel KB-TZ2 design strength based on concrete failure modes in uncracked concrete per ACI 318 Ch. 17, applicable for both hammer and core drilled installations [1,2,3,4]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension (lesser of concrete breakout / pullout) - ΦN_n				Shear (lesser of concrete breakout or pryout) - ΦV_n			
			f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)
1/4	1-1/2 (38)	1 3/4 (44)	705 (3.1)	760 (3.4)	850 (3.8)	995 (4.4)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
3/8	1-1/2 (38)	1 7/8 (48)	1,435 (6.4)	1,570 (7.0)	1,815 (8.1)	2,220 (9.9)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
	2 (51)	2 1/2 (64)	2,205 (9.8)	2,415 (10.7)	2,790 (12.4)	3,420 (15.2)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	2-1/2 (64)	3 (76)	2,720 (12.1)	2,910 (12.9)	3,235 (14.4)	3,760 (16.7)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
1/2	2 (51)	2 1/2 (64)	2,195 (9.8)	2,390 (10.6)	2,725 (12.1)	3,285 (14.6)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	2-1/2 (64)	3 (76)	2,605 (11.6)	2,855 (12.7)	3,295 (14.7)	4,040 (18.0)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
	3-1/4 (83)	3 3/4 (95)	3,575 (15.9)	3,915 (17.4)	4,520 (20.1)	5,540 (24.6)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
5/8	2-3/4 (70)	3 1/4 (83)	2,655 (11.8)	2,910 (12.9)	3,360 (14.9)	4,115 (18.3)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)
	3-1/4 (83)	3 3/4 (95)	3,910 (17.4)	4,220 (18.8)	4,765 (21.2)	5,645 (25.1)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
	4 (102)	4 1/2 (114)	5,235 (23.3)	5,700 (25.4)	6,525 (29.0)	7,895 (35.1)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
3/4	3-1/4 (83)	4 (102)	4,570 (20.3)	5,005 (22.3)	5,780 (25.7)	7,080 (31.5)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
	3-3/4[6] (95)	4 1/2 (114)	6,370 (28.3)	6,980 (31.0)	8,060 (35.9)	9,870 (43.9)	13,725 (61.1)	15,035 (66.9)	17,360 (77.2)	21,265 (94.6)
	4-3/4 (121)	5 1/2 (140)	8,075 (35.9)	8,845 (39.3)	10,215 (45.4)	12,510 (55.6)	17,390 (77.4)	19,050 (84.7)	22,000 (97.9)	26,945 (119.9)
1	4 (102)	4 5/8 (117)	7,020 (31.2)	7,690 (34.2)	8,880 (39.5)	10,875 (48.4)	15,120 (67.3)	16,565 (73.7)	19,125 (85.1)	23,425 (104.2)
	5-3/4 (146)	6 3/8 (162)	12,100 (53.8)	13,255 (59.0)	15,305 (68.1)	18,745 (83.4)	26,060 (115.9)	28,545 (127.0)	32,965 (146.6)	40,370 (179.6)

3.3.5

Table 19 — Hilti Stainless Steel KB-TZ2 design strength based on concrete failure modes in cracked concrete per ACI 318 Ch. 17, applicable for both hammer and core drilled installations [1,2,3,4,5]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension (lesser of concrete breakout / pullout) - ΦN_n				Shear (lesser of concrete breakout or pryout) - ΦV_n			
			f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.1 MPa) lb (kN)
1/4	1-1/2 (38)	1 3/4 (44)	300 (1.3)	330 (1.5)	380 (1.7)	465 (2.1)	1,095 (4.9)	1,195 (5.3)	1,385 (6.2)	1,695 (7.5)
3/8	1-1/2 (38)	1 7/8 (48)	1,255 (5.6)	1,375 (6.1)	1,585 (7.1)	1,940 (8.6)	1,350 (6.0)	1,480 (6.6)	1,710 (7.6)	2,090 (9.3)
	2 (51)	2 1/2 (64)	1,930 (8.6)	2,115 (9.4)	2,440 (10.9)	2,990 (13.3)	2,080 (9.3)	2,275 (10.1)	2,630 (11.7)	3,220 (14.3)
	2-1/2 (64)	3 (76)	2,185 (9.7)	2,390 (10.6)	2,765 (12.3)	3,385 (15.1)	4,705 (20.9)	5,155 (22.9)	5,950 (26.5)	7,285 (32.4)
1/2	2 (51)	2 1/2 (64)	1,565 (7.0)	1,710 (7.6)	1,975 (8.8)	2,420 (10.8)	1,685 (7.5)	1,845 (8.2)	2,130 (9.5)	2,605 (11.6)
	2-1/2 (64)	3 (76)	2,700 (12.0)	2,955 (13.1)	3,415 (15.2)	4,180 (18.6)	5,810 (25.8)	6,365 (28.3)	7,350 (32.7)	9,000 (40.0)
	3-1/4[8] (83)	3 3/4 (95)	3,235 (14.4)	3,545 (15.8)	4,095 (18.2)	5,015 (22.3)	6,970 (31.0)	7,640 (34.0)	8,820 (39.2)	10,800 (48.0)
5/8	2-3/4 (70)	3 1/4 (83)	3,110 (13.8)	3,410 (15.2)	3,935 (17.5)	4,820 (21.4)	6,705 (29.8)	7,345 (32.7)	8,480 (37.7)	10,385 (46.2)
	3-1/4 (83)	3 3/4 (95)	4,000 (17.8)	4,380 (19.5)	5,060 (22.5)	6,195 (27.6)	8,615 (38.3)	9,435 (42.0)	10,895 (48.5)	13,345 (59.4)
	4 (102)	4 1/2 (114)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
3/4	3-1/4 (83)	4 (102)	4,000 (17.8)	4,380 (19.5)	5,060 (22.5)	6,195 (27.6)	8,615 (38.3)	9,435 (42.0)	10,895 (48.5)	13,345 (59.4)
	3-3/4[7] (95)	4 1/2 (114)	4,955 (22.0)	5,430 (24.2)	6,270 (27.9)	7,680 (34.2)	10,675 (47.5)	11,695 (52.0)	13,505 (60.1)	16,540 (73.6)
	4-3/4 (121)	5 1/2 (140)	5,715 (25.4)	6,260 (27.8)	7,230 (32.2)	8,855 (39.4)	15,220 (67.7)	16,670 (74.2)	19,250 (85.6)	23,575 (104.9)
1	4 (102)	4 5/8 (117)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,665 (43.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
	5-3/4 (146)	6 3/8 (162)	9,410 (41.9)	10,310 (45.9)	11,905 (53.0)	14,580 (64.9)	20,270 (90.2)	22,205 (98.8)	25,640 (114.1)	31,400 (139.7)

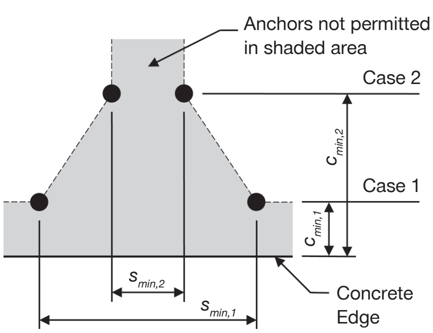
1 See Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 22 to 33 as necessary. Compare to the steel values in Table 20. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis}$ = 0.75.
No reduction needed for seismic shear, except for the 3/4 bolts where $\alpha_{V,seis}$ = 0.81. See Section 3.1.8 for additional information on seismic applications.
6 For core drilled installations of 3/4" anchors installed at 3-3/4" effective embedment, apply a reduction factor of 0.89 to the design tension strength.
7 For core drilled installations of 3/4" anchors installed at 3-3/4" effective embedment, apply a reduction factor of 0.81 to the design tension strength.
8 For core drilled installations of 1/2" anchors installed at 3-1/4 effective embedment, apply a reduction factor of 0.85 to the design tension strength.

Table 20 — Hilti Stainless Steel KB-TZ2 design strength based on steel failure per ACI 318 Ch. 17 [1,2]

Nominal anchor diameter in.	Effective embedment depth in. (mm)			Tensile [3] ΦN_{sa} lb (kN)	Shear [4] ΦV_{sa} lb (kN)	Seismic Shear [5] ΦV_{sa} lb (kN)
1/4	1-1/2 (38)			2,190 (9.7)	950 (4.2)	720 (3.2)
3/8	1-1/2 (38)			4,635 (20.6)	3,000 (13.3)	3,000 (13.3)
3/8	2 (51)		2-1/2 (64)	4,635 (20.6)	3,175 (14.1)	3,175 (14.1)
1/2	2 (51)	2-1/2 (64)	3-1/4 (83)	8,905 (39.6)	5,425 (24.1)	5,425 (24.1)
5/8	2-3/4 (70)	3-1/4 (83)	4 (102)	14,125 (62.8)	8,030 (35.7)	8,030 (35.7)
3/4	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	18,035 (80.2)	10,765 (47.9)	8,755 (38.9)
1 (25.4)	4 (102)			35,215 (156.6)	14,920 (66.4)	8,755 (38.9)
1 (25.4)	5-3/4 (146)			35,215 (156.6)	20,410 (90.8)	8,755 (38.9)

1 See Section 3.1.8 to convert design strength value to ASD value.
2 Hilti KB-TZ2 stainless steel anchors are to be considered ductile steel elements.
3 Tensile $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Ch. 17.
4 Shear values determined by static shear tests with $\phi V_{sa} < \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
5 Seismic shear values determined by seismic shear tests with $\phi V_{sa} \leq \phi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318 Ch. 17.
See Section 3.1.8 for additional information on seismic applications.

Figure 3



For a specific edge distance, the permitted spacing is calculated as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})}(c - c_{min,2})$$

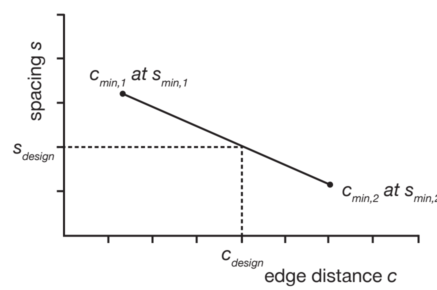


Table 21 — Hilti KB-TZ2 stainless steel installation parameters[1]

Setting information	Symbol	Units	1/4	3/8	3/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8	3/4	3/4	3/4	1	1
Effective embedment	h_{ef}	in.	1-1/2	1-1/2	2	2-1/2	2	2-1/2	3 1/4	2-3/4	3-1/4	4	3-1/4	3-3/4	4-3/4	4	5-3/4
		(mm)	(38)	(38)	(51)	(64)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)	(102)	(146)
Min. member thickness	h_{min}	in.	3-1/4	3-1/4	4	5	4	5	5-1/2	5	5-1/2	6	5-1/2	6	8	8	10
		(mm)	(83)	(83)	(102)	(127)	(102)	(127)	(140)	(127)	(140)	(152)	(140)	(152)	(203)	(203)	(254)
Case 1	$c_{min,1}$	in.	1-1/2	5	2-1/2	2-1/2	2-3/4	2-1/2	2-1/4	4	3-1/4	2-1/4	5	4	3 3/4	3-3/4	3
		(mm)	(38)	(127)	(64)	(64)	(70)	(64)	(57)	(102)	(83)	(57)	(127)	(102)	(95)	(95)	(76)
	for $s_{min,1} \geq$	in.	1-1/2	8	5	5	5-1/2	4-1/2	5-1/4	7	5-1/2	7	11	7-1/2	5 3/4	10	6-3/4
		(mm)	(38)	(203)	(127)	(127)	(140)	(114)	(133)	(178)	(140)	(178)	(279)	(191)	(146)	(254)	(171)
Case 2	$c_{min,2}$	in.	1-1/2	8	4	3-1/2	4-1/8	4-1/2	4-1/2	5-1/2	4	4-1/4	8	6	5-1/4	4-1/4	3-3/4
		(mm)	(38)	(203)	(102)	(89)	(105)	(114)	(114)	(140)	(102)	(108)	(203)	(152)	(133)	(108)	(95)
	for $s_{min,2} \geq$	in.	1-1/2	5	2-1/4	2-1/4	2-3/4	2-1/2	2	5-1/2	2-3/4	3	5	4	4	5	4-3/4
		(mm)	(38)	(127)	(57)	(57)	(70)	(64)	(51)	(140)	(70)	(76)	(127)	(102)	(102)	(127)	(121)

Nominal Anchor diameter (in.) applies to columns 1/4 through 1.

1 Linear interpolation is permitted to establish an edge distance and spacing combination between Case 1 and Case 2. Linear interpolation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$, will determine the permissible spacings.

Table 22 — Load adjustment factors for Stainless Steel 1/4-in. diameter KB-TZ2 in uncracked concrete [1,2]

1/4-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear [3] f_{AV}	Edge distance in shear ⊥ Toward edge f_{RV}	Edge distance in shear ∥ To edge f_{RV}	Conc. thickness factor in shear [4] f_{HV}
Effective Embedment h_{ef}		in. (mm)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)
Nominal Embedment h_{nom}		in. (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	1-1/2	(38)	0.67	0.42	0.56	0.23	0.42	n/a
	2	(51)	0.72	0.51	0.58	0.35	0.51	n/a
	2-1/2	(64)	0.78	0.63	0.60	0.49	0.63	n/a
	3	(76)	0.83	0.75	0.63	0.65	0.75	n/a
	3-1/4	(83)	0.86	0.81	0.64	0.73	0.81	0.74
	3-1/2	(89)	0.89	0.88	0.65	0.82	0.88	0.76
	4	(102)	0.94	1.00	0.67	1.00	1.00	0.82
	5	(127)	1.00		0.71			0.91
	6	(152)			0.75			1.00
	7	(178)			0.79			
	8	(203)			0.83			
	9	(229)			0.88			
	> 12	(305)			1.00			

Table 23 — Load adjustment factors for Stainless Steel 1/4-in. diameter KB-TZ2 in cracked concrete [1,2]

1/4-in. KB-TZ2 cracked concrete			Spacing factor in tension f_{AN}	Edge distance factor in tension f_{RN}	Spacing factor in shear [3] f_{AV}	Edge distance in shear ⊥ Toward edge f_{RV}	Edge distance in shear ∥ To edge f_{RV}	Conc. thickness factor in shear [4] f_{HV}
Effective Embedment h_{ef}		in. (mm)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)	1-1/2 (38)
Nominal Embedment h_{nom}		in. (mm)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)	1-3/4 (44)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	1-1/2	(38)	0.67	0.75	0.57	0.29	0.59	n/a
	2	(51)	0.72	0.91	0.60	0.45	0.91	n/a
	2-1/2	(64)	0.78	1.00	0.62	0.63	1.00	n/a
	3	(76)	0.83		0.65	0.83		n/a
	3-1/4	(83)	0.86		0.66	0.94		0.80
	3-1/2	(89)	0.89		0.67	1.00		0.83
	4	(102)	0.94		0.70			0.89
	5	(127)	1.00		0.75			0.99
	6	(152)			0.80			1.00
	7	(178)			0.84			
	8	(203)			0.89			
	9	(229)			0.94			
	> 12	(305)			1.00			

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

Table 24 — Load adjustment factors for Stainless Steel 3/8-in. diameter KB-TZ2 in uncracked concrete [1,4]

3/8-in. KB-TZ2 uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in. (mm)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)
Nominal Embedment h_{nom}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm): 2-1/4	(57)	n/a	0.69	0.65	n/a	n/a	n/a	n/a	0.57	0.55	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2-1/2	(64)	n/a	0.71	0.67	n/a	0.48	0.68	n/a	0.58	0.55	n/a	0.31	0.18	n/a	0.48	0.37	n/a	n/a	n/a
3	(76)	n/a	0.75	0.70	n/a	0.55	0.77	n/a	0.59	0.56	n/a	0.40	0.24	n/a	0.55	0.48	n/a	n/a	n/a
3-1/4	(83)	n/a	0.77	0.72	n/a	0.59	0.81	n/a	0.60	0.57	n/a	0.45	0.27	n/a	0.59	0.54	0.69	n/a	n/a
3-1/2	(89)	n/a	0.79	0.73	n/a	0.64	0.86	n/a	0.61	0.58	n/a	0.51	0.30	n/a	0.64	0.61	0.72	n/a	n/a
4	(102)	n/a	0.83	0.77	n/a	0.73	0.97	n/a	0.62	0.59	n/a	0.62	0.37	n/a	0.73	0.74	0.77	0.70	n/a
5	(127)	1.00	0.92	0.83	1.00	0.91	1.00	0.69	0.65	0.61	1.00	0.87	0.52	1.00	0.91	1.00	0.86	0.78	0.66
6	(152)	1.00	1.00	0.90	1.00	1.00		0.72	0.68	0.63	1.00	1.00	0.68	1.00	1.00		0.94	0.85	0.72
8	(203)	1.00		1.00	1.00			0.80	0.74	0.67	1.00		1.00	1.00			1.00	0.98	0.83
10	(254)							0.87	0.80	0.71								1.00	0.93
12	(305)							0.94	0.86	0.76									1.00
18	(457)							1.00	1.00	0.89									
> 24	(610)									1.00									

Table 25 — Load adjustment factors for Stainless Steel 3/8-in. diameter KB-TZ2 in cracked concrete [1,4]

3/8-in. KB-TZ2 cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in. (mm)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)
Nominal Embedment h_{nom}	in. (mm)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)	1-7/8 (48)	2-1/2 (64)	3 (76)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm): 2-1/4	(57)	n/a	0.69	0.65	n/a	n/a	n/a	n/a	0.58	0.55	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2-1/2	(64)	n/a	0.71	0.67	n/a	0.87	0.75	n/a	0.59	0.55	n/a	0.40	0.18	n/a	0.80	0.37	n/a	n/a	n/a
3	(76)	n/a	0.75	0.70	n/a	1.00	0.85	n/a	0.61	0.56	n/a	0.52	0.24	n/a	1.00	0.48	n/a	n/a	n/a
3-1/4	(83)	n/a	0.77	0.72	n/a	1.00	0.90	n/a	0.62	0.57	n/a	0.59	0.27	n/a	1.00	0.55	0.78	n/a	n/a
3-1/2	(89)	n/a	0.79	0.73	n/a	1.00	0.95	n/a	0.63	0.58	n/a	0.66	0.31	n/a	1.00	0.61	0.81	n/a	n/a
4	(102)	n/a	0.83	0.77	n/a	1.00	1.00	n/a	0.64	0.59	n/a	0.81	0.37	n/a	1.00	0.75	0.86	0.76	n/a
5	(127)	1.00	0.92	0.83	1.00			0.73	0.68	0.61	1.00	1.00	0.52	1.00		1.00	0.96	0.85	0.66
6	(152)	1.00	1.00	0.90	1.00			0.78	0.72	0.63	1.00		0.69	1.00			1.00	0.93	0.72
8	(203)	1.00		1.00	1.00			0.87	0.79	0.67	1.00		1.00	1.00				1.00	0.83
10	(254)							0.96	0.86	0.72									0.93
12	(305)							1.00	0.93	0.76									1.00
18	(457)								1.00	0.89									
> 24	(610)									1.00									

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 3 and Table 21 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 26 — Load adjustment factors for Stainless Steel 1/2-in. diameter KB-TZ2 in uncracked concrete [1,2]

1/2-in. KB-TZ2 uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in. (mm)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)
Nominal Embedment h_{nom}	in. (mm)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)																			
2	(51)	n/a	n/a	0.60	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2-1/4	(57)	n/a	n/a	0.62	n/a	n/a	0.40	n/a	n/a	0.54	n/a	n/a	0.12	n/a	n/a	0.24	n/a	n/a	n/a
2-1/2	(64)	n/a	n/a	0.63	n/a	0.45	0.42	n/a	n/a	0.55	n/a	0.20	0.14	n/a	0.40	0.28	n/a	n/a	n/a
2-3/4	(70)	n/a	0.68	0.64	0.51	0.48	0.44	n/a	0.56	0.55	0.35	0.23	0.16	0.51	0.46	0.33	n/a	n/a	n/a
3	(76)	0.75	0.70	0.65	0.55	0.51	0.46	0.59	0.57	0.55	0.40	0.26	0.19	0.55	0.51	0.37	n/a	n/a	n/a
4	(102)	0.83	0.77	0.71	0.73	0.64	0.56	0.62	0.59	0.57	0.62	0.40	0.29	0.73	0.64	0.56	0.70	n/a	n/a
4-1/8	(105)	0.84	0.78	0.71	0.75	0.66	0.57	0.63	0.59	0.57	0.65	0.42	0.30	0.75	0.66	0.57	0.71	n/a	n/a
4-1/2	(114)	0.88	0.80	0.73	0.82	0.72	0.61	0.64	0.60	0.58	0.74	0.48	0.34	0.82	0.72	0.61	0.74	n/a	n/a
4-3/4	(121)	0.90	0.82	0.74	0.86	0.76	0.64	0.64	0.61	0.59	0.80	0.52	0.37	0.86	0.76	0.64	0.76	n/a	n/a
5	(127)	0.92	0.83	0.76	0.91	0.80	0.67	0.65	0.61	0.59	0.87	0.56	0.40	0.91	0.80	0.67	0.78	0.67	n/a
5-1/4	(133)	0.94	0.85	0.77	0.95	0.84	0.70	0.66	0.62	0.60	0.93	0.61	0.43	0.95	0.84	0.70	0.80	0.69	n/a
5-1/2	(140)	0.96	0.87	0.78	1.00	0.88	0.73	0.67	0.63	0.60	1.00	0.65	0.46	1.00	0.88	0.73	0.82	0.71	0.63
6	(152)	1.00	0.90	0.81		0.96	0.80	0.68	0.64	0.61		0.74	0.53		0.96	0.80	0.85	0.74	0.66
8	(203)		1.00	0.91		1.00	1.00	0.74	0.68	0.64		1.00	0.81		1.00	1.00	0.98	0.85	0.76
12	(305)			1.00				0.86	0.77	0.72			1.00				1.00	1.00	0.93
18	(457)							1.00	0.91	0.83									1.00
24	(610)								1.00	0.93									
> 30	(762)									1.00									

3.3.5

Table 27 — Load adjustment factors for Stainless Steel 1/2-in. diameter KB-TZ2 in cracked concrete [1,2]

1/2-in. KB-TZ2 cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in. (mm)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)
Nominal Embedment h_{nom}	in. (mm)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)																			
2	(51)	n/a	n/a	0.60	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2-1/4	(57)	n/a	n/a	0.62	n/a	n/a	0.61	n/a	n/a	0.54	n/a	n/a	0.12	n/a	n/a	0.24	n/a	n/a	n/a
2-1/2	(64)	n/a	n/a	0.63	n/a	0.75	0.65	n/a	n/a	0.55	n/a	0.16	0.14	n/a	0.33	0.29	n/a	n/a	n/a
2-3/4	(70)	n/a	0.68	0.64	0.93	0.80	0.68	n/a	0.55	0.55	0.62	0.19	0.16	0.93	0.38	0.33	n/a	n/a	n/a
3	(76)	0.75	0.70	0.65	1.00	0.85	0.71	0.63	0.56	0.55	0.71	0.21	0.19	1.00	0.43	0.38	n/a	n/a	n/a
4	(102)	0.83	0.77	0.71	1.00	1.00	0.86	0.68	0.58	0.57	1.00	0.33	0.29	1.00	0.66	0.58	0.84	n/a	n/a
4-1/8	(105)	0.84	0.78	0.71	1.00	1.00	0.88	0.68	0.58	0.58	1.00	0.34	0.30	1.00	0.69	0.61	0.85	n/a	n/a
4-1/2	(114)	0.88	0.80	0.73		1.00	0.94	0.70	0.59	0.58		0.39	0.34		0.79	0.69	0.89	n/a	n/a
4-3/4	(121)	0.90	0.82	0.74			0.98	0.71	0.59	0.59		0.43	0.37		0.85	0.75	0.91	n/a	n/a
5	(127)	0.92	0.83	0.76			1.00	0.72	0.60	0.59		0.46	0.40		0.92	0.81	0.94	0.63	n/a
5-1/4	(133)	0.94	0.85	0.77				0.73	0.60	0.60		0.49	0.43		0.99	0.87	0.96	0.65	n/a
5-1/2	(140)	0.96	0.87	0.78				0.74	0.61	0.60		0.53	0.47		1.00	0.93	0.98	0.66	0.63
6	(152)	1.00	0.90	0.81				0.76	0.62	0.61		0.60	0.53			1.00	1.00	0.69	0.66
8	(203)		1.00	0.91				0.85	0.66	0.65		0.93	0.82					0.80	0.76
12	(305)			1.00				1.00	0.74	0.72		1.00	1.00					0.98	0.94
18	(457)								0.86	0.83								1.00	1.00
24	(610)								0.98	0.94									
> 30	(762)								1.00	1.00									

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 3 and Table 21 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 28 — Load adjustment factors for Stainless Steel 5/8-in. diameter KB-TZ2 in uncracked concrete [1,2]

5/8-in. KB-TZ2 uncracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in. (mm)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)
Nominal Embedment h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm): 2-1/4	(57)	n/a	n/a	n/a	n/a	n/a	0.38	n/a	n/a	n/a	n/a	n/a	0.10	n/a	n/a	0.20	n/a	n/a	n/a
2-3/4	(70)	n/a	0.64	n/a	n/a	n/a	0.42	n/a	0.55	n/a	n/a	n/a	0.13	n/a	n/a	0.27	n/a	n/a	n/a
3	(76)	n/a	0.65	0.63	n/a	n/a	0.44	n/a	0.56	0.55	n/a	n/a	0.15	n/a	n/a	0.30	n/a	n/a	n/a
3-1/4	(83)	n/a	0.67	0.64	n/a	0.56	0.46	n/a	0.56	0.55	n/a	0.22	0.17	n/a	0.45	0.34	n/a	n/a	n/a
4	(102)	n/a	0.71	0.67	0.40	0.65	0.51	n/a	0.58	0.56	0.25	0.31	0.23	0.40	0.61	0.47	n/a	n/a	n/a
4-1/4	(108)	n/a	0.72	0.68	0.43	0.67	0.53	n/a	0.58	0.57	0.28	0.34	0.26	0.43	0.67	0.51	n/a	n/a	n/a
5	(127)	n/a	0.76	0.71	0.50	0.77	0.60	n/a	0.59	0.58	0.35	0.43	0.33	0.50	0.77	0.60	0.58	n/a	n/a
5-1/2	(140)	0.83	0.78	0.73	0.55	0.85	0.64	0.59	0.60	0.59	0.41	0.49	0.38	0.55	0.85	0.64	0.61	0.65	n/a
6	(152)	0.86	0.81	0.75	0.60	0.92	0.69	0.60	0.61	0.59	0.46	0.56	0.43	0.60	0.92	0.69	0.63	0.67	0.62
7	(178)	0.92	0.86	0.79	0.70	1.00	0.80	0.62	0.63	0.61	0.59	0.71	0.54	0.70	1.00	0.80	0.68	0.73	0.67
8	(203)	0.98	0.91	0.83	0.80		0.91	0.63	0.65	0.63	0.72	0.87	0.66	0.80		0.91	0.73	0.78	0.71
10	(254)	1.00	1.00	0.92	1.00		1.00	0.67	0.69	0.66	1.00	1.00	0.92	1.00		1.00	0.82	0.87	0.80
12	(305)			1.00				0.70	0.73	0.69			1.00				0.89	0.95	0.87
24	(610)							0.90	0.95	0.88							1.00	1.00	1.00
> 36	(914)							1.00	1.00	1.00									

Table 29 — Load adjustment factors for Stainless Steel 5/8-in. diameter KB-TZ2 in cracked concrete [1,2]

5/8-in. KB-TZ2 cracked concrete		Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}	in. (mm)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)	2-3/4 (70)	3-1/4 (83)	4 (102)
Nominal Embedment h_{nom}	in. (mm)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	3-3/4 (95)	4-1/2 (114)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm): 2-1/4	(57)	n/a	n/a	n/a	n/a	n/a	0.56	n/a	n/a	n/a	n/a	n/a	0.10	n/a	n/a	0.20	n/a	n/a	n/a
2-3/4	(70)	n/a	0.64	n/a	n/a	n/a	0.61	n/a	0.55	n/a	n/a	n/a	0.13	n/a	n/a	0.27	n/a	n/a	n/a
3	(76)	n/a	0.65	0.63	n/a	n/a	0.64	n/a	0.55	0.55	n/a	n/a	0.15	n/a	n/a	0.31	n/a	n/a	n/a
3-1/4	(83)	n/a	0.67	0.64	n/a	0.75	0.66	n/a	0.55	0.55	n/a	0.18	0.17	n/a	0.37	0.35	n/a	n/a	n/a
4	(102)	n/a	0.71	0.67	0.98	0.86	0.75	n/a	0.57	0.56	0.31	0.25	0.24	0.62	0.50	0.47	n/a	n/a	n/a
4-1/4	(108)	n/a	0.72	0.68	1.00	0.90	0.78	n/a	0.57	0.57	0.34	0.27	0.26	0.68	0.55	0.52	n/a	n/a	n/a
5	(127)	n/a	0.76	0.71	1.00	1.00	0.87	n/a	0.58	0.58	0.43	0.35	0.33	0.87	0.70	0.66	0.62	n/a	n/a
5-1/2	(140)	0.83	0.78	0.73	1.00		0.93	0.61	0.59	0.59	0.50	0.40	0.38	1.00	0.81	0.76	0.65	0.60	n/a
6	(152)	0.86	0.81	0.75			1.00	0.61	0.60	0.60	0.57	0.46	0.43		0.92	0.87	0.68	0.63	0.62
7	(178)	0.92	0.86	0.79				0.63	0.62	0.61	0.72	0.58	0.55		1.00	1.00	0.73	0.68	0.67
8	(203)	0.98	0.91	0.83				0.65	0.63	0.63	0.88	0.71	0.67				0.78	0.73	0.71
10	(254)	1.00	1.00	0.92				0.69	0.67	0.66	1.00	0.99	0.93				0.87	0.81	0.80
12	(305)			1.00				0.73	0.70	0.69		1.00	1.00				0.96	0.89	0.87
24	(610)							0.96	0.90	0.88							1.00	1.00	1.00
> 36	(914)							1.00	1.00	1.00									

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 3 and Table 21 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 30 — Load adjustment factors for Stainless Steel 3/4-in. diameter KB-TZ2 in uncracked concrete [1,2]

3/4-in. KB-TZ2 uncracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}		in.	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4
		(mm)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)
Nominal Embedment h_{nom}		in.	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2
		(mm)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	3-3/4	(95)	n/a	n/a	n/a	n/a	n/a	0.47	n/a	n/a	n/a	n/a	n/a	0.18	n/a	n/a	0.36	n/a	n/a	n/a
	4	(102)	n/a	0.68	0.64	n/a	0.44	0.48	n/a	0.56	0.56	n/a	0.24	0.20	n/a	0.44	0.40	n/a	n/a	n/a
	4-1/2	(114)	n/a	0.70	0.66	n/a	0.48	0.52	n/a	0.57	0.56	n/a	0.29	0.24	n/a	0.48	0.47	n/a	n/a	n/a
	5	(127)	0.76	0.72	0.68	0.42	0.51	0.55	0.57	0.58	0.57	0.27	0.33	0.28	0.42	0.51	0.55	n/a	n/a	n/a
	5-1/4	(133)	0.77	0.73	0.68	0.44	0.53	0.57	0.57	0.58	0.57	0.29	0.36	0.30	0.44	0.53	0.57	n/a	n/a	n/a
	5-1/2	(140)	0.78	0.74	0.69	0.46	0.55	0.59	0.58	0.59	0.58	0.31	0.39	0.32	0.46	0.55	0.59	0.55	n/a	n/a
	5-3/4	(146)	0.79	0.76	0.70	0.48	0.58	0.61	0.58	0.59	0.58	0.33	0.41	0.34	0.48	0.58	0.61	0.57	n/a	n/a
	6	(152)	0.81	0.77	0.71	0.50	0.60	0.63	0.58	0.60	0.58	0.35	0.44	0.36	0.50	0.60	0.63	0.58	0.62	n/a
	7	(178)	0.86	0.81	0.75	0.58	0.70	0.70	0.60	0.61	0.60	0.45	0.55	0.46	0.58	0.70	0.70	0.62	0.67	n/a
	7-1/2	(191)	0.88	0.83	0.76	0.63	0.75	0.75	0.60	0.62	0.61	0.49	0.61	0.51	0.63	0.75	0.75	0.65	0.69	n/a
	8	(203)	0.91	0.86	0.78	0.67	0.80	0.80	0.61	0.63	0.61	0.54	0.68	0.56	0.67	0.80	0.80	0.67	0.72	0.67
	9	(229)	0.96	0.90	0.82	0.75	0.90	0.90	0.63	0.64	0.63	0.65	0.81	0.67	0.75	0.90	0.90	0.71	0.76	0.71
	10	(254)	1.00	0.94	0.85	0.83	1.00	1.00	0.64	0.66	0.64	0.76	0.94	0.78	0.83	1.00	1.00	0.75	0.80	0.75
	11	(279)	1.00	0.99	0.89	0.92			0.65	0.68	0.66	0.88	1.00	0.90	0.92			0.78	0.84	0.79
	12	(305)		1.00	0.92	1.00			0.67	0.69	0.67	1.00		1.00	1.00			0.82	0.88	0.82
	16	(406)			1.00				0.72	0.76	0.73							0.94	1.00	0.95
	18	(457)							0.75	0.79	0.75							1.00		1.00
	24	(610)							0.83	0.89	0.84									
	> 36	(914)							1.00	1.00	1.00									

3.3.5

Table 31 — Load adjustment factors for Stainless Steel 3/4-in. diameter KB-TZ2 in cracked concrete [1,2]

3/4-in. KB-TZ2 cracked concrete			Spacing factor in tension f_{AN}			Edge distance factor in tension f_{RN}			Spacing factor in shear [3] f_{AV}			Edge distance in shear ⊥ Toward edge f_{RV}			Edge distance in shear ∥ To edge f_{RV}			Concrete thickness factor in shear [4] f_{HV}		
Effective Embedment h_{ef}		in.	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4	3-1/4	3-3/4	4-3/4
		(mm)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)	(83)	(95)	(121)
Nominal Embedment h_{nom}		in.	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2	4	4-1/2	5-1/2
		(mm)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)	(102)	(114)	(140)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm)	3-3/4	(95)	n/a	n/a	n/a	n/a	n/a	0.65	n/a	n/a	n/a	n/a	n/a	0.15	n/a	n/a	0.29	n/a	n/a	n/a
	4	(102)	n/a	0.68	0.64	n/a	0.78	0.68	n/a	0.56	0.55	n/a	0.22	0.16	n/a	0.44	0.32	n/a	n/a	n/a
	4-1/2	(114)	n/a	0.70	0.66	n/a	0.85	0.73	n/a	0.57	0.56	n/a	0.26	0.19	n/a	0.52	0.39	n/a	n/a	n/a
	5	(127)	0.76	0.72	0.68	1.00	0.91	0.77	0.59	0.58	0.56	0.37	0.31	0.23	0.74	0.61	0.45	n/a	n/a	n/a
	5-1/4	(133)	0.77	0.73	0.68	1.00	0.95	0.80	0.59	0.58	0.56	0.40	0.33	0.24	0.79	0.66	0.49	n/a	n/a	n/a
	5-1/2	(140)	0.78	0.74	0.69	1.00	0.98	0.83	0.59	0.58	0.57	0.43	0.35	0.26	0.85	0.71	0.52	0.61	n/a	n/a
	5-3/4	(146)	0.79	0.76	0.70	1.00	1.00	0.85	0.60	0.59	0.57	0.46	0.38	0.28	0.91	0.76	0.56	0.63	n/a	n/a
	6	(152)	0.81	0.77	0.71	1.00	1.00	0.88	0.60	0.59	0.57	0.49	0.40	0.30	0.97	0.81	0.59	0.64	0.60	n/a
	7	(178)	0.86	0.81	0.75	1.00		0.99	0.62	0.61	0.59	0.61	0.51	0.37	1.00	1.00	0.75	0.69	0.65	n/a
	7-1/2	(191)	0.88	0.83	0.76	1.00		1.00	0.63	0.61	0.59	0.68	0.56	0.41	1.00		0.83	0.72	0.67	n/a
	8	(203)	0.91	0.86	0.78	1.00			0.64	0.62	0.60	0.75	0.62	0.46	1.00		0.91	0.74	0.70	0.63
	9	(229)	0.96	0.90	0.82				0.65	0.64	0.61	0.89	0.74	0.54			1.00	0.79	0.74	0.67
	10	(254)	1.00	0.94	0.85				0.67	0.65	0.62	1.00	0.87	0.64				0.83	0.78	0.70
	11	(279)	1.00	0.99	0.89				0.69	0.67	0.64		1.00	0.74				0.87	0.82	0.74
	12	(305)		1.00	0.92				0.71	0.68	0.65			0.84				0.91	0.85	0.77
	16	(406)			1.00				0.77	0.74	0.70			1.00				1.00	0.98	0.89
	18	(457)							0.81	0.77	0.72								1.00	0.94
	24	(610)							0.91	0.86	0.80									1.00
	> 36	(914)							1.00	1.00	0.94									

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 3 and Table 21 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 32 — Load adjustment factors for Stainless Steel 1-in. diameter KB-TZ2 in uncracked concrete [1,4]

1-in. KB-TZ2 uncracked concrete		Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear [3] f_{AV}		Edge distance in shear ⊥ Toward edge f_{RV}		Edge distance in shear ∥ To edge f_{RV}		Concrete thickness factor in shear [4] f_{HV}	
Effective Embedment h_{ef}	in. (mm)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)
Nominal Embedment h_{nom}	in. (mm)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm) 3	(76)	n/a	n/a	n/a	0.302	n/a	n/a	n/a	0.085	n/a	0.170	n/a	n/a
3-3/4	(95)	n/a	n/a	0.393	0.332	n/a	n/a	0.199	0.119	0.393	0.238	n/a	n/a
4	(102)	n/a	n/a	0.409	0.342	n/a	n/a	0.219	0.131	0.409	0.262	n/a	n/a
4-1/4	(108)	n/a	n/a	0.425	0.352	n/a	n/a	0.240	0.144	0.425	0.287	n/a	n/a
4-3/4	(121)	n/a	0.638	0.458	0.373	n/a	0.551	0.284	0.170	0.458	0.339	n/a	n/a
5	(127)	0.708	0.645	0.475	0.384	0.576	0.554	0.306	0.183	0.475	0.366	n/a	n/a
6	(152)	0.750	0.674	0.545	0.429	0.591	0.565	0.403	0.241	0.545	0.429	n/a	n/a
6-3/4	(171)	0.781	0.696	0.614	0.464	0.602	0.573	0.481	0.287	0.614	0.464	n/a	n/a
8	(203)	0.833	0.732	0.727	0.525	0.621	0.586	0.620	0.371	0.727	0.525	0.696	n/a
10	(254)	0.917	0.790	0.909	0.645	0.652	0.608	0.867	0.518	0.909	0.645	0.778	0.656
12	(305)	1.000	0.848	1.000	0.774	0.682	0.629	1.000	0.681	1.000	0.774	0.853	0.718
18	(457)		1.000		1.000	0.773	0.694		1.000		1.000	1.000	0.880
24	(610)					0.864	0.758						1.000
36	(914)					1.000	0.887						
> 48	(1219)						1.000						

Table 33 — Load adjustment factors for Stainless Steel 1-in. diameter KB-TZ2 in cracked concrete [1,4]

1-in. KB-TZ2 cracked concrete		Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear [3] f_{AV}		Edge distance in shear ⊥ Toward edge f_{RV}		Edge distance in shear ∥ To edge f_{RV}		Concrete thickness factor in shear [4] f_{HV}	
Effective Embedment h_{ef}	in. (mm)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)	4.00 (102)	5.75 (146)
Nominal Embedment h_{nom}	in. (mm)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)	4-5/8 (117)	6-3/8 (162)
Spacing (s) / Edge Distance (c_a) / Concrete Thickness (h) - in. (mm) 3	(76)	n/a	n/a	n/a	0.542	n/a	n/a	n/a	0.081	n/a	0.162	n/a	n/a
3-3/4	(95)	n/a	n/a	0.721	0.596	n/a	n/a	0.170	0.113	0.340	0.226	n/a	n/a
4	(102)	n/a	n/a	0.750	0.614	n/a	n/a	0.188	0.124	0.375	0.249	n/a	n/a
4-1/4	(108)	n/a	n/a	0.779	0.633	n/a	n/a	0.205	0.136	0.411	0.272	n/a	n/a
4-3/4	(121)	n/a	0.638	0.840	0.671	n/a	0.549	0.243	0.161	0.485	0.322	n/a	n/a
5	(127)	0.708	0.645	0.871	0.690	0.568	0.552	0.262	0.174	0.524	0.348	n/a	n/a
6	(152)	0.750	0.674	1.000	0.770	0.582	0.562	0.344	0.228	0.689	0.457	n/a	n/a
6-3/4	(171)	0.781	0.696		0.833	0.592	0.570	0.411	0.273	0.822	0.545	n/a	n/a
8	(203)	0.833	0.732		0.943	0.609	0.583	0.530	0.352	1.000	0.703	0.661	n/a
10	(254)	0.917	0.790		1.000	0.636	0.604	0.741	0.491		0.983	0.739	0.644
12	(305)	1.000	0.848			0.664	0.625	0.974	0.646		1.000	0.809	0.706
18	(457)		1.000			0.746	0.687	1.000	1.000			0.991	0.864
24	(610)					0.828	0.749					1.000	0.998
36	(914)					0.991	0.874						1.000
> 48	(1219)					1.000	0.998						

1 Linear interpolation not permitted
2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.
3 Spacing factor reduction in shear, f_{AV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{AV} = f_{AN}$.
4 Concrete thickness reduction factor in shear, f_{HV}, is applicable when edge distance $c < 3h_{ef}$. If $c \geq 3h_{ef}$ then $f_{HV} = 1.0$.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 3 and Table 21 to calculate permissible edge distance, spacing and concrete thickness combinations.

Table 34 — Hilti Carbon Steel KB-TZ2 in the soffit of uncracked lightweight concrete over metal deck, applicable for both hammer and core drilled installations [1,2,3,4,5,6]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Installation per Figure 4				Installation per Figure 5			
			Min. conc. thickness [8] in. (mm)	Tension - ΦN$_n$		Shear - ΦV$_n$	Min. conc. thickness [8] in. (mm)	Tension - ΦN$_n$		Shear - ΦV$_n$
				f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	2-1/2 (64)	775 (3.4)	820 (3.6)	1,060 (4.7)	2-1/4 (57)	620 (2.8)	655 (2.9)	730 (3.2)
3/8	1-1/2 (38)	1-7/8 (48)	2-1/2 (64)	1,205 (5.4)	1,285 (5.7)	880 (3.9)	2-1/4 (57)	645 (2.9)	685 (3.0)	1,540 (6.9)
	2 (51)	2-1/2 (64)	2-1/2 (64)	1,705 (7.6)	1,830 (8.1)	1,380 (6.1)	2-1/4 (57)	1,615 (7.2)	1,730 (7.7)	1,630 (7.3)
	2-1/2 (64)	3 (76)	2-1/2 (64)	1,945 (8.7)	2,155 (9.6)	1,380 (6.1)	N/A	N/A	N/A	N/A
1/2	1-1/2 (38)	2 (51)	2-1/2 (64)	1,205 (5.4)	1,390 (6.2)	1,165 (5.2)	2-1/4 (57)	1,180 (5.2)	1,365 (6.1)	1,740 (7.7)
	2 (51)	2-1/2 (64)	2-1/2 (64)	1,790 (8.0)	2,015 (9.0)	1,470 (6.5)	2-1/4 (57)	1,235 (5.5)	1,395 (6.2)	2,065 (9.2)
	2-1/2 (64)	3 (76)	2-1/2 (64)	2,435 (10.8)	2,645 (11.8)	2,135 (9.5)	N/A	N/A	N/A	N/A
	3-1/4 (83)	3-3/4 (95)	2-1/2 (64)	3,065 (13.6)	3,390 (15.1)	2,755 (12.3)	3-1/4 (83)	1,730 (7.7)	1,915 (8.5)	2,250 (10.0)
5/8	2-3/4 (70)	3-1/4 (83)	2-1/2 (64)	2,870 (12.8)	3,315 (14.7)	2,480 (11.0)	3-1/4 (83)	1,925 (8.6)	2,225 (9.9)	2,655 (11.8)
	4 (102)	4-1/2 (114)	2-1/2 (64)	3,780 (16.8)	4,365 (19.4)	3,025 (13.5)	N/A	N/A	N/A	N/A
3/4	3-1/4 (83)	4 (102)	2-1/2 (64)	2,470 (11.0)	2,730 (12.1)	2,655 (11.8)	N/A	N/A	N/A	N/A
	3-3/4[9] (95)	4-1/2 (114)	3-1/4 (83)	3,115 (13.9)	3,405 (15.1)	5,110 (22.7)	N/A	N/A	N/A	N/A

3.3.5

Table 35 — Hilti Carbon Steel KB-TZ2 in the soffit of cracked lightweight concrete over metal deck, applicable for both hammer and core drilled installations [1,2,3,4,5,6,7]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Installation per Figure 4				Installation per Figure 5			
			Min. conc. thickness [8] in. (mm)	Tension - ΦN$_n$		Shear - ΦV$_n$	Min. conc. thickness [8] in. (mm)	Tension - ΦN$_n$		Shear - ΦV$_n$
				f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)
1/4	1-1/2 (38)	1-3/4 (44)	2-1/2 (64)	230 (1.0)	260 (1.2)	1,060 (4.7)	2-1/4 (57)	185 (0.8)	205 (0.9)	730 (3.2)
3/8	1-1/2 (38)	1-7/8 (48)	2-1/2 (64)	1,055 (4.7)	1,220 (5.4)	880 (3.9)	2-1/4 (57)	565 (2.5)	650 (2.9)	1,540 (6.9)
	2 (51)	2-1/2 (64)	2-1/2 (64)	1,490 (6.6)	1.705 (7.6)	1,380 (6.1)	2-1/4 (57)	1,385 (6.2)	1,580 (7.0)	1,630 (7.3)
	2-1/2 (64)	3 (76)	2-1/2 (64)	1,565 (7.0)	1.695 (7.5)	1,380 (6.1)	N/A	N/A	N/A	N/A
1/2	1-1/2 (38)	2 (51)	2-1/2 (64)	1,075 (4.8)	1.230 (5.5)	1,165 (5.2)	2-1/4 (57)	960 (4.3)	1,100 (4.9)	1,740 (7.7)
	2 (51)	2-1/2 (64)	2-1/2 (64)	1,390 (6.2)	1.600 (7.1)	1,470 (6.5)	2-1/4 (57)	960 (4.3)	1,110 (4.9)	2,065 (9.2)
	2-1/2 (64)	3 (76)	2-1/2 (64)	2,130 (9.5)	2,435 (10.9)	2,135 (9.5)	N/A	N/A	N/A	N/A
	3-1/4 (83)	3-3/4 (95)	2-1/2 (64)	2,170 (9.7)	2,435 (10.8)	2,755 (12.3)	3-1/4 (83)	1,230 (5.5)	1,380 (6.1)	2,250 (10.0)
5/8	2-3/4 (70)	3-1/4 (83)	2-1/2 (64)	2,555 (11.4)	2,950 (13.1)	2,480 (11.0)	3-1/4 (83)	1,715 (7.6)	1,980 (8.8)	2,655 (11.8)
	4 (102)	4-1/2 (114)	2-1/2 (64)	2,855 (12.7)	3,300 (14.7)	3,025 (13.5)	N/A	N/A	N/A	N/A
3/4	3-1/4 (83)	4 (102)	2-1/2 (64)	2,160 (9.6)	2,395 (10.7)	2,655 (11.8)	N/A	N/A	N/A	N/A
	3-3/4 (95)	4-1/2 (114)	3-1/4 (83)	2,425 (10.8)	2,735 (12.2)	5,110 (22.7)	N/A	N/A	N/A	N/A

1 See Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
4 Tabular values are lightweight concrete and no additional reduction factor is needed.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Comparison of the tabular values to the steel strength is not necessary. Tabular values control.
7 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis}$ = 0.75, except for 3/4 x 4-3/4 h_{ef} where $\alpha_{N,seis}$ = 0.73. See Section 3.1.8 for additional information on seismic applications.
8 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 4 and 5.
9 For core drilled installations of 3/4" anchors installed at 3-3/4" effective embedment, apply a reduction factor of 0.89 to the design tension strength of anchors installed in uncracked concrete.

Figure 4 — Installation of Hilti KB-TZ2 carbon steel in the soffit of concrete over metal deck floor and roof assemblies – W deck[2]

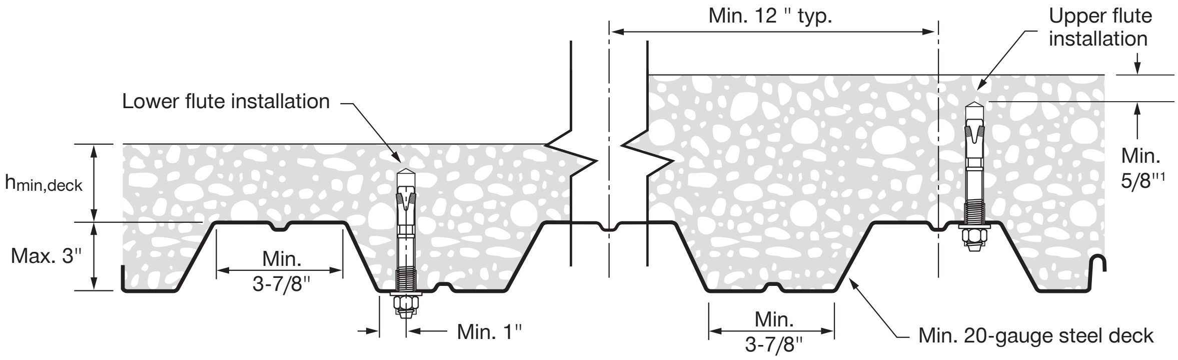
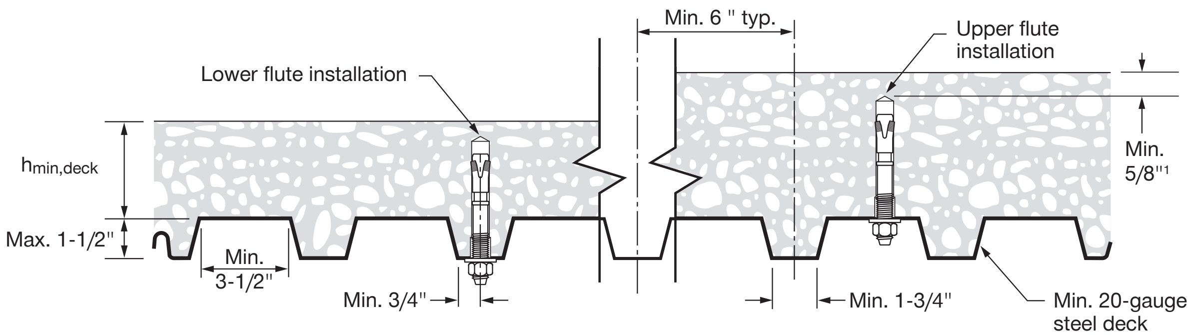


Figure 5 — Installation of Hilti KB-TZ2 carbon steel in the soffit of concrete over metal deck floor and roof assemblies – B deck



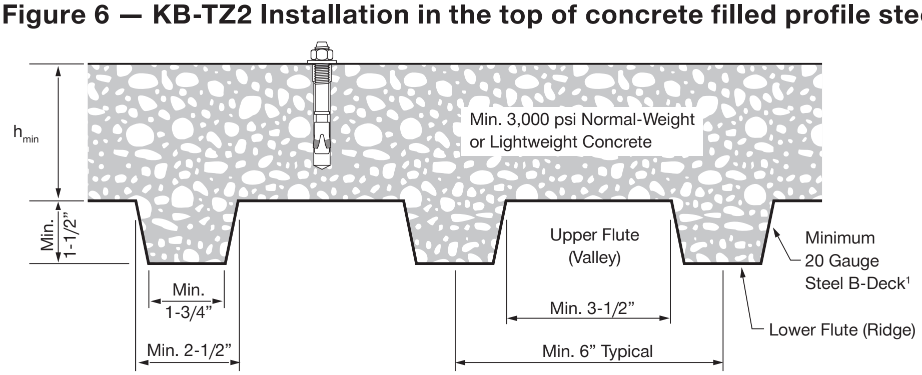
1 5/8" clearance between the bottom of the drilled hole and the concrete surface is only applicable for upper flute installations. Refer to Tables 34 and 35 for minimum concrete thicknesses for installations into the lower flute.
2 For flute widths greater or equal to 4-1/2", the shear strength may be increased. Refer to ESR-4266 for more information.

Table 36 — Hilti KB-TZ2 carbon steel anchors setting information for installation on the top of concrete-filled profile steel deck asseblies according to figure 6 [1,2,3]

Design information	Symbol	Units	Nominal anchor diameter (in)			
			1/4	3/8		1/2
Effective minimum embedment	h_{ef}	in.	1-1/2	1-1/2	2	2
Nominal minimum embedment	h_{nom}	in.	1-3/4	1-7/8	2-1/2	2-1/2
Minimum hole depth	h_0	in.	2	2	2-1/2	2-3/4
Minimum concrete thickness [4]	$h_{min,deck}$	in.	2-1/2	2-1/2	2-1/2	3-2/4
Critical edge distance	$c_{ac,deck,top}$	in.	5	8	4-1/2	6
Minimum edge distance	$c_{min,deck,top}$	in.	3	16		7-1/2
Minimum spacing	$s_{min,deck,top}$	in.	3	8		9
Required installation torque	T_{inst}	ft-lb	4	30		50

1 Installation must comply with Figure 6 of this report.
2 Design capacity shall be based on calculations according to values in Tables 2 and 3 of this report.
3 Applicable for $h_{min,deck}$ < 4-in. For $h_{min,deck}$ ≥ 4-in, use setting information in Tables 1 and 5 of this section.
4 Minimun concrete thickness refers to concrete thickness above the upper flute. See Figure 6.

Figure 6 — KB-TZ2 Installation in the top of concrete filled profile steel deck assemblies



1 1-1/2-in B-deck as a minimum profile size. Other deck profiles meeting the B-deck minimum dimensions are also permitted

DESIGN DATA IN CONCRETE PER CSA A23.3

CSA A23.3 Annex D Design

Limit State Design of anchors is described in the provisions of CSA A23.3 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. Tables 37, 38, 42 and 43 in this section contains the Limit State Design tables that are based on the published loads in ICC-ES Evaluation Report ESR 4266 and converted for use with CSA A23.3 Annex D. Tables 40, 41, 45 and 46 are Hilti Simplified Design Tables which are pre-factored resistance tables based on the design parameters and variables in Tables 37, 38, 42 and 43. All the figures in the previous ACI 318 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

For a detailed explanation of the tables developed in accordance with CSA A23.3 Annex D, refer to Section 3.1.8. Technical assistance is available by contacting Hilti Canada at (800) 363 4458 or at www.hilti.ca.

Table 37 — Hilti KB-TZ2 carbon steel tension design information in accordance with CSA A23.3 Annex D, applicable for both hammer and core drilled installations[1]

Design parameter	Symbol	Units	Nominal anchor diameter (in.)																Ref A23.3
			1/4	3/8			1/2				5/8			3/4			1		
Effective min. embedment [2]	h_{ef}	in. (mm)	1-1/2 (38)	1-1/2 (38)	2 (51)	2-1/2 (64)	1-1/2 (38)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-3/4 (70)	3-1/4 (83)	4 (102)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	4 (102)	5-3/4 (146)	
Min. concrete thickness	h_{min}	in. (mm)	See Table 5																
Minimum edge distance	c_{min}	in. (mm)	See Table 5																
Minimum anchor spacing	s_{min}	in. (mm)	See Table 5																
Tension, steel failure modes																			
Steel embed. material resistance factor for reinforcement	Φ_s	-	0.85	0.85			0.85				0.85			0.85			0.85		8.4.3
Resistance modification factor for tension, steel failure modes[3]	R	-	0.80	0.80			0.80				0.80			0.80			0.80		D.5.3
Min. specified yield strength	f_{ya}	psi (N/mm^2)	100,900 (696)	100,900 (696)			96,300 (664)				87,000 (600)			84,700 (584)			75,000 (517)		
Min. specified ult. strength	f_{ut}	psi (N/mm^2)	122,400 (844)	126,200 (870)			114,000 (786)				106,700 (736)			105,900 (730)			88,000 (607)		
Effective tensile stress area	$A_{se,N}$	in^2 (mm^2)	0.024 (15.4)	0.051 (33.2)			0.099 (63.6)				0.164 (106.0)			0.239 (154.4)			0.470 (303.2)		
Factored steel resistance in tension	N_{sar}	lb (kN)	1,985 (8.8)	4,420 (19.7)			7,645 (34.0)				11,925 (53.0)			17,230 (76.6)			28,145 (125.2)		D.6.1.2
Tension, concrete failure modes																			
Anchor category	-	-	3	1			1				1			1			1		D.5.3 (c)
Concrete material resistance factor	Φ_c	-	0.65	0.65			0.65				0.65			0.65			0.65		8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B [5]	R	-	0.75	1.00			1.00				1.00			1.00			1.00		D.5.3 (c)
Coeff. for factored conc. breakout resistance, uncracked concrete	$k_{c,uncr}$	-	10.0	10.0	10.0	10.0	11.3	11.3	10.0	10.0	10.0	10.0	10.0	11.3	11.3[7]	10.0	11.3	10.0	D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$	-	7.1	8.8	8.8	7.1	10.0	8.8	8.8	7.1	8.8	8.8	7.1	8.8	8.8	8.8	8.8	8.8	D.6.2.2
Modification factor for anchor resistance, tension, uncracked conc. [4]	$\Psi_{c,N}$	-	1.0	1.0			1.0				1.0			1.0			1.0		
Critical edge distance	c_{ac}	in. (mm)	4 (102)	5 (127)	4-3/8 (111)	5-1/2 (140)	8 (203)	5-1/2 (140)	6-3/4 (171)	10 (254)	10 (254)	11-1/2 (292)	8-3/4 (222)	12 (305)	10 (254)	9 (229)	11 (279)	16 (406)	
Factored pullout resistance in 20 MPa uncracked concrete [6]	$N_{pr,uncr}$	lb (kN)	1,055 (4.7)	N/A	N/A	2,865 (12.7)	N/A	N/A	N/A	N/A	3,770 (16.8)	N/A	6,300 (28.0)	N/A	N/A	N/A	N/A	N/A	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete [6]	$N_{pr,cr}$	lb (kN)	325 (1.4)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6,000 (26.7)	N/A	8,275 (36.8)	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete, seismic [6]	$N_{pr,eq}$	lb (kN)	325 (1.4)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5,880 (26.1)	N/A	8,275 (36.8)	D.6.3.2
Normalization factor, uncracked concrete	n_{uncr}	-	0.20	0.22	0.24	0.35	0.50	0.42	0.29	0.35	0.50	0.48	0.50	0.35	0.31	0.39	N/A	0.38	
Normalization factor, cracked concrete, seismic	n_{cr}	-	0.39	0.50	0.46	0.28	0.47	0.50	0.48	0.40	0.50	0.47	0.50	0.36	0.42	0.29	N/A	0.50	

1 Design information in this table is taken from ICC-ES ESR-4266, dated December, 2020, and revised July, 2021 Tables 4 and 6, and converted for use with CSA A23.3 Annex D.
2 See Figure 1 of this document.
3 The KB-TZ2 carbon steel anchor is considered a ductile steel element as defined by CSA A23.3 Annex D section D.2.
4 For all design cases, $\Psi_{c,N}$ = 1.0. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
5 For use with the load combinations of CSA A23.3 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.
6 For all design cases, $\Psi_{c,P}$ = 1.0. Tabular value for pullout strength is for a concrete compressive strength of 2,900 psi (20.0 M Pa). Pullout strength for concrete compressive strength greater than 2,900 psi (20.2 MPa) may be increased by multiplying the tabular pullout strength by $(f'_c / 2,900)^n$ for psi, or $(f'_c / 20.2)^n$ for MPa,
7 For core drilled installation $k_{c,uncr}$ = 10.0 for 3/4" diameter installed at 3-3/4" effective embedment.

Table 38 — Hilti KB-TZ2 carbon steel shear design information in accordance with CSA A23.3 Annex D, applicable for both hammer and core drilled installations [1]

Design parameter	Symbol	Units	Nominal anchor diameter (in.)																Ref A23.3
			1/4	3/8			1/2				5/8			3/4			1		
Anchor O.D.	d_a	in.	0.25	0.375			0.5				0.625			0.75			1.00		
		(mm)	(6.4)	(9.5)			(12.7)				(15.9)			(19.1)			(25.4)		
Effective min. embedment [2]	h_{ef}	in.	1-1/2	1-1/2	2	2-1/2	1-1/2	2	2-1/2	3-1/4	2-3/4	3-1/4	4	3-1/4	3-3/4	4-3/4	4	5-3/4	
		(mm)	(38)	(38)	(51)	(64)	(38)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)	(102)	(146)	
Shear, steel failure modes																			
Steel embed. material resistance factor for reinforcement	ϕ_s	-	0.85	0.85			0.85				0.85			0.85			0.85		8.4.3
Resistance modification factor for shear, steel failure modes [3]	R	-	0.75	0.75			0.75				0.75			0.75			0.75		D.5.3
Factored steel resistance in shear	V_{sar}	lb	855	2,055			3,530				6,540			8,800			11,980	14,550	D.7.1.2
		(kN)	(3.8)	(9.1)			(15.7)				(29.1)			(39.1)			(53.3)	(64.7)	
Factored steel resistance in shear, seismic	$V_{sar,eq}$	lb	855	2,055			3,530				6,540			8,800			8,800		
		(kN)	(3.8)	(9.1)			(15.7)				(29.1)			(39.1)			(39.1)		
Shear, concrete failure modes																			
Concrete material resistance factor	ϕ_c	-	0.65	0.65			0.65				0.65			0.65			0.65		8.4.2
Resistance modification factor for shear, concrete failure modes [4]	R	-	1.00	1.00			1.00				1.00			1.00			1.00		D.5.3
Load bearing length of anchor in shear	ℓ_e	in.	1-1/2	1-1/2	2	2-1/2	1-1/2	2	2-1/2	3-1/4	2-3/4	3-1/4	4	3-1/4	3-3/4	4-3/4	4	5-3/4	
		(mm)	(38)	(38)	(51)	(64)	(38)	(51)	(64)	(83)	(70)	(83)	(102)	(83)	(95)	(121)	(102)	(146)	
Effectiveness factor for pryout	k_{cp}	-	1.0	1.0	1.0	2.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	

1 Design information in this table is taken from ICC-ES ESR-4266, dated December, 2020, and revised July, 2021 Tables 4 and 6, and converted for use with CSA A23.3 Annex D.
2 See Figure 1 of this document.
3 The KB-TZ2 carbon steel anchor is considered a ductile steel element as defined by CSA A23.3 Annex D section D.2.
4 For use with the load combinations of CSA A23.3 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.

Table 39 — Steel resistance for Hilti KB-TZ2 carbon steel anchors [1,2]

Nominal anchor diameter in.	Effective embedment depth in. (mm)			Tensile [3] ϕN_{sar} lb (kN)	Shear [4] ϕV_{sar} lb (kN)	Seismic Shear [5] $\phi V_{sar,eq}$ lb (kN)
1/4	1-1/2 (38)			1,985 (8.8)	855 (3.8)	855 (3.8)
3/8	1-1/2 (38)			4,420 (19.7)	2,055 (9.1)	2,055 (9.1)
3/8	2 (51)	2-1/2 (64)		4,420 (19.7)	2,160 (9.6)	2,160 (9.6)
1/2	1-1/2 (38)	2 (51)		7,645 (34.0)	3,530 (15.7)	3,530 (15.7)
1/2	2-1/2 (64)	3-1/4 (83)		7,645 (34.0)	4,385 (19.5)	4,385 (19.5)
5/8	2-3/4 (70)	3-1/4 (83)	4 (102)	11,925 (53.0)	6,540 (29.1)	6,540 (29.1)
3/4	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	17,230 (76.6)	8,800 (39.1)	8,800 (39.1)
1	4 (102)			28,145 (125.2)	11,980 (53.3)	8,800 (39.1)
1	5-3/4 (146)			28,145 (125.2)	14,550 (64.7)	8,800 (39.1)

1 See Section 3.1.8 to convert factored resistance value to ASD value.
2 Hilti KB-TZ2 carbon steel anchors are to be considered ductile steel elements.
3 Tensile $N_{sar} = A_{se,N}\ \phi_s\ f_{uta}\ R$ as noted in CSA A23.3 Annex D.
4 Shear determined by static shear tests with $V_{sar} < 0.6\ A_{se,V}\ \phi_s\ f_{ut}a\ R$ as noted in CSA A23.3 Annex D.
5 Seismic shear values determined by seismic shear tests with $V_{sar,eq} \leq 0.60\ A_{se,V}\ \phi_s\ f_{uta}\ R$ as noted in CSA A23.3 Annex D. See Section 3.1.8 for additional information on seismic applications.

Table 40 — Hilti KB-TZ2 carbon steel factored resistance based on concrete failure modes in uncracked concrete, applicable for both hammer and core drilled installations [1,2,3,4]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension - N_r				Shear - V_r			
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	1 1/2 (38)	1 3/4 (44)	1,055 (4.7)	1,105 (4.9)	1,145 (5.1)	1,210 (5.4)	1,535 (6.8)	1,720 (7.6)	1,880 (8.4)	2,175 (9.7)
3/8	1 1/2 (38)	1 7/8 (48)	1,535 (6.8)	1,720 (7.6)	1,880 (8.4)	2,175 (9.7)	1,535 (6.8)	1,720 (7.6)	1,880 (8.4)	2,175 (9.7)
	2 (51)	2 1/2 (64)	2,365 (10.5)	2,645 (11.8)	2,900 (12.9)	3,345 (14.9)	2,365 (10.5)	2,645 (11.8)	2,900 (12.9)	3,345 (14.9)
	2 1/2 (64)	3 (76)	2,865 (12.7)	3,095 (13.8)	3,300 (14.7)	3,650 (16.2)	3,305 (14.7)	3,695 (16.4)	4,050 (18.0)	4,675 (20.8)
1/2	1 1/2 (38)	2 (51)	1,735 (7.7)	1,940 (8.6)	2,125 (9.5)	2,455 (10.9)	1,735 (7.7)	1,940 (8.6)	2,125 (9.5)	2,455 (10.9)
	2 (51)	2 1/2 (64)	2,675 (11.9)	2,990 (13.3)	3,275 (14.6)	3,780 (16.8)	2,675 (11.9)	2,990 (13.3)	3,275 (14.6)	3,780 (16.8)
	2 1/2 (64)	3 (76)	3,305 (14.7)	3,695 (16.4)	4,050 (18.0)	4,675 (20.8)	3,305 (14.7)	3,695 (16.4)	4,050 (18.0)	4,675 (20.8)
	3 1/4 (83)	3 3/4 (95)	4,900 (21.8)	5,480 (24.4)	6,005 (26.7)	6,930 (30.8)	9,805 (43.6)	10,960 (48.8)	12,005 (53.4)	13,865 (61.7)
5/8	2 3/4 (70)	3 1/4 (83)	3,770 (16.8)	4,215 (18.7)	4,615 (20.5)	5,330 (23.7)	7,630 (33.9)	8,530 (37.9)	9,345 (41.6)	10,790 (48.0)
	3 1/4 (83)	3 3/4 (95)	4,900 (21.8)	5,480 (24.4)	6,005 (26.7)	6,930 (30.8)	9,805 (43.6)	10,960 (48.8)	12,005 (53.4)	13,865 (61.7)
	4 (102)	4 1/2 (114)	6,300 (28.0)	7,045 (31.3)	7,720 (34.3)	8,910 (39.6)	13,385 (59.5)	14,965 (66.6)	16,395 (72.9)	18,930 (84.2)
3/4	3 1/4 (83)	4 (102)	4,900 (21.8)	5,480 (24.4)	6,005 (26.7)	6,930 (30.8)	9,805 (43.6)	10,960 (48.8)	12,005 (53.4)	13,865 (61.7)
	3 3/4[6] (95)	4 1/2 (114)	6,865 (30.5)	7,675 (34.1)	8,405 (37.4)	9,710 (43.2)	13,730 (61.1)	15,350 (68.3)	16,815 (74.8)	19,415 (86.4)
	4 3/4 (121)	5 1/2 (140)	8,660 (38.5)	9,685 (43.1)	10,605 (47.2)	12,250 (54.5)	17,320 (77.0)	19,365 (86.1)	21,215 (94.4)	24,495 (109.0)
1	4 (102)	4 5/8 (117)	7,560 (33.6)	8,455 (37.6)	9,260 (41.2)	10,695 (47.6)	15,125 (67.3)	16,910 (75.2)	18,525 (82.4)	21,390 (95.1)
	5 3/4 (146)	6 3/8 (162)	11,535 (51.3)	12,895 (57.4)	14,125 (62.8)	16,310 (72.6)	23,070 (102.6)	25,790 (114.7)	28,255 (125.7)	32,625 (145.1)

3.3.5

Table 41 — Hilti KB-TZ2 carbon steel factored resistance based on concrete failure modes in cracked concrete, applicable for both hammer and core drilled installations [1,2,3,4,5]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension - N_r				Shear - V_r			
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	1 1/2 (38)	1 3/4 (44)	325 (1.4)	350 (1.6)	380 (1.7)	425 (1.9)	1,090 (4.9)	1,220 (5.4)	1,335 (5.9)	1,545 (6.9)
3/8	1 1/2 (38)	1 7/8 (48)	1,350 (6.0)	1,510 (6.7)	1,655 (7.4)	1,915 (8.5)	1,350 (6.0)	1,510 (6.7)	1,655 (7.4)	1,915 (8.5)
	2 (51)	2 1/2 (64)	2,080 (9.3)	2,330 (10.4)	2,550 (11.3)	2,945 (13.1)	2,080 (9.3)	2,330 (10.4)	2,550 (11.3)	2,945 (13.1)
	2 1/2 (64)	3 (76)	2,350 (10.4)	2,625 (11.7)	2,875 (12.8)	3,320 (14.8)	2,350 (10.4)	2,625 (11.7)	2,875 (12.8)	3,320 (14.8)
1/2	1 1/2 (38)	2 (51)	1,535 (6.8)	1,720 (7.6)	1,880 (8.4)	2,175 (9.7)	1,535 (6.8)	1,720 (7.6)	1,880 (8.4)	2,175 (9.7)
	2 (51)	2 1/2 (64)	2,080 (9.3)	2,330 (10.4)	2,550 (11.3)	2,945 (13.1)	2,080 (9.3)	2,330 (10.4)	2,550 (11.3)	2,945 (13.1)
	2 1/2 (64)	3 (76)	2,910 (12.9)	3,255 (14.5)	3,565 (15.9)	4,115 (18.3)	2,910 (12.9)	3,255 (14.5)	3,565 (15.9)	4,115 (18.3)
	3 1/4 (83)	3 3/4 (95)	3,480 (15.5)	3,890 (17.3)	4,260 (19.0)	4,920 (21.9)	6,960 (31.0)	7,780 (34.6)	8,525 (37.9)	9,845 (43.8)
5/8	2 3/4 (70)	3 1/4 (83)	3,355 (14.9)	3,755 (16.7)	4,110 (18.3)	4,750 (21.1)	6,715 (29.9)	7,505 (33.4)	8,225 (36.6)	9,495 (42.2)
	3 1/4 (83)	3 3/4 (95)	4,315 (19.2)	4,820 (21.5)	5,285 (23.5)	6,100 (27.1)	8,625 (38.4)	9,645 (42.9)	10,565 (47.0)	12,200 (54.3)
	4 (102)	4 1/2 (114)	4,750 (21.1)	5,310 (23.6)	5,820 (25.9)	6,720 (29.9)	9,505 (42.3)	10,625 (47.3)	11,640 (51.8)	13,440 (59.8)
3/4	3 1/4 (83)	4 (102)	4,315 (19.2)	4,820 (21.5)	5,285 (23.5)	6,100 (27.1)	8,625 (38.4)	9,645 (42.9)	10,565 (47.0)	12,200 (54.3)
	3 3/4 (95)	4 1/2 (114)	5,345 (23.8)	5,975 (26.6)	6,545 (29.1)	7,335 (33.6)	10,690 (47.6)	11,955 (53.2)	13,095 (58.2)	15,120 (67.3)
	4 3/4 (121)	5 1/2 (140)	6,000 (26.7)	6,400 (28.5)	6,745 (30.0)	7,335 (32.6)	15,240 (67.8)	17,040 (75.8)	18,670 (83.0)	21,555 (95.9)
1	4 (102)	4 5/8 (117)	5,890 (26.2)	6,585 (29.3)	7,215 (32.1)	8,330 (37.0)	11,780 (52.4)	13,170 (58.6)	14,425 (64.2)	16,660 (74.1)
	5 3/4 (146)	6 3/8 (162)	8,275 (36.8)	9,250 (41.1)	10,135 (45.1)	11,700 (52.0)	20,300 (90.3)	22,695 (101.0)	24,865 (110.6)	28,710 (127.7)

1 See Section 3.1.8 to convert factored resistance value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 6 to 17 as necessary. Compare to the steel values in Table 39. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis}$ = 0.75, except for 3/4 x 4-3/4 h_{ef} where $\alpha_{N,seis}$ = 0.73. No reduction needed for seismic shear. See Section 3.1.8 for additional information on seismic applications.
6 For core drilled installations of 3/4“ anchors installed at 3-3/4“ effective embedment, apply a reduction factor of 0.89 to the design tension strength

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Table 42 — Hilti KB-TZ2 stainless steel tension design information in accordance with CSA A23.3 Annex D, applicable for both hammer and core drilled installations [1]

Design parameter	Symbol	Units	Nominal anchor diameter (in.)															Ref
			1/4	3/8			1/2			5/8			3/4			1		A23.3
Effective min. embedment [2]	h_{ef}	in. (mm)	1-1/2 (38)	1-1/2 (38)	2 (51)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-3/4 (70)	3-1/4 (83)	4 (102)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	4 (102)	5-3/4 (146)	
Min. concrete thickness	h_{min}	in. (mm)	See Table 19															
Minimum edge distance	c_{min}	in. (mm)	See Table 19															
Minimum anchor spacing	s_{min}	in. (mm)	See Table 19															
Tension, steel failure modes																		
Steel embed. material resistance factor for reinforcement	Φ_s	-	0.85	0.85			0.85			0.85			0.85			0.85		8.4.3
Resistance modification factor for tension, steel failure modes [3]	R	-	0.80	0.80			0.80			0.80			0.80			0.80		
Min. specified yield strength	f_{ya}	psi (N/mm^2)	100,900 (696)	96,300 (664)			96,300 (664)			91,600 (632)			84,100 (580)			65,000 (448)		
Min. specified ult. strength	f_{ut}	psi (N/mm^2)	122,400 (844)	120,100 (828)			120,400			114,600 (790)			100,500 (693)			99,900 (689)		
Effective tensile stress area	$A_{se,N}$	in^2 (mm^2)	0.024 (15.4)	0.051 (33.2)			0.099 (63.6)			0.164 (106.0)			0.239 (154.4)			0.470 (303.2)		
Factored steel resistance in tension	N_{sar}	lb (kN)	2,050 (9.1)	4,210 (18.7)			8,070 (35.9)			12,810 (57.0)			16,350 (72.7)			31,930 (142.0)		D.6.1.2
Tension, concrete failure modes																		
Anchor category	-	-	3	1			1			1			1			1		D.5.3 (c)
Concrete material resistance factor	Φ_c	-	0.65	0.65			0.65			0.65			0.65			0.65		8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B [5]	R	-	0.75	1.00			1.00			1.00			1.00			1.00		D.5.3 (c)
Coeff. for factored conc. breakout resistance, uncracked concrete	$k_{c,uncr}$	-	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.3[7]	10.0	11.3	11.3	D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$	-	7.1	8.8	8.8	7.1	7.1	8.8	7.1	8.8	8.8	7.1	8.8	8.8[7]	8.8	10.0	8.8	D.6.2.2
Modification factor for anchor resistance, tension, uncracked conc. [4]	$\Psi_{c,N}$	-	1.0	1.0			1.0			1.0			1.0			1.0		
Critical edge distance	c_{ac}	in. (mm)	4 (102)	4-1/2 (114)	5-1/2 (140)	4-1/8 (105)	5-1/2 (140)	6-1/4 (159)	7-1/2 (191)	10 (254)	7 (178)	9 (229)	12 (305)	10 (254)	10 (254)	11 (279)	15-1/2 (394)	
Factored pullout resistance in 20 MPa uncracked concrete [6]	$N_{pr,uncr}$	lb (kN)	810 (3.6)	N/A	N/A	2,875 (12.8)	2,355 (10.5)	2,810 (12.5)	3,855 (17.1)	2,860 (12.7)	4,165 (18.5)	5,615 (25.0)	N/A	N/A	N/A	N/A	N/A	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete [6]	$N_{pr,cr}$	lb (kN)	360 (1.6)	N/A	N/A	N/A	N/A	N/A	N/A[8]	N/A	N/A	N/A	N/A	N/A	6,160 (27.4)	N/A	N/A	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete, seismic [6]	$N_{pr,eq}$	lb (kN)	360 (1.6)	N/A	N/A	N/A	N/A	N/A	N/A[8]	N/A	N/A	N/A	N/A	N/A	6,160 (27.4)	N/A	N/A	D.6.3.2
Normalization factor, uncracked concrete	n_{uncr}	-	0.39	N/A	N/A	0.37	0.46	0.50	0.50	0.50	0.42	0.47	N/A	N/A	0.30	N/A	N/A	
Normalization factor, cracked concrete, seismic	n_{cr}	-	0.50	N/A	N/A	N/A	N/A	N/A	0.50	N/A	N/A	N/A	N/A	N/A	0.50	N/A	N/A	

1 Design information in this table is taken from ICC-ES ESR-4266, dated December, 2020, and revised July, 2021 Tables 5 and 7, and converted for use with CSA A23.3 Annex D.
2 See Figure 1 of this document.
3 The KB-TZ2 stainless steel anchor is considered a ductile steel element as defined by CSA A23.3 Annex D section D.2.
4 For all design cases, $\Psi_{c,N}$ = 1.0. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
5 For use with the load combinations of CSA A23.3 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.
6 For all design cases, $\Psi_{c,P}$ = 1.0. Tabular value for pullout strength is for a concrete compressive strength of 2,900 psi (20.0 MPa). Pullout strength for concrete compressive strength greater than 2,900 psi (20.2 MPa) may be increased by multiplying the tabular pullout strength by (f'_c / 2,900)n for psi, or (f'_c / 20.2)^n for MPa.
7 For core drilled installation $k_{c,uncr}$ = 10.0 and $k_{c,cr}$ = 7.1 for 3/4" diameter installed at 3-3/4" effective embedment
8 For core drilled installation, $N_{p,c}$r = 4245 lb (18.9 kN) and $N_{p,eq}$ = 4245 lb (18.9 kN) for 1/2-inch diameter anchors installed at 3-3/4 inches (95 mm) effective embedment.

Table 43 — Hilti KB-TZ2 stainless steel shear design information in accordance with CSA A23.3 Annex D, applicable for both hammer and core drilled installations[1]

Design parameter	Symbol	Units	Nominal anchor diameter (in.)															Ref
			1/4	3/8			1/2			5/8			3/4			1		A23.3
Anchor O.D.	d_a	in. (mm)	0.25 (6.4)	0.375 (9.5)			0.5 (12.7)			0.625 (15.9)			0.75 (19.1)			1.00 (25.4)		
Effective min. embedment [2]	h_{ef}	in. (mm)	1-1/2 (38)	1-1/2 (38)	2 (51)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-3/4 (70)	3-1/4 (83)	4 (102)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	4 (102)	5-3/4 (146)	
Shear, steel failure modes																		
Steel embed. material resistance factor for reinforcement	Φ_s	-	0.85	0.85			0.85			0.85			0.85			0.85		8.4.3
Resistance modification factor for shear, steel failure modes [3]	R	-	0.75	0.75			0.75			0.75			0.75			0.75		
Factored steel resistance in shear	V_{sar}	lb (kN)	930 (4.1)	2,940 (13.1)	3,115 (13.9)		5,320 (23.7)			7,875 (35.0)			10,555 (47.0)			14,635 (65.1)	20,020 (89.1)	D.7.1.2
Factored steel resistance in shear, seismic	$V_{sar,eq}$	lb (kN)	710 (3.2)	2,940 (13.1)	3,115 (13.9)		5,320 (23.7)			7,875 (35.0)			8,585 (38.2)			8,585 (38.2)		
Shear, concrete failure modes																		
Concrete material resistance factor	Φ_c	-	0.65	0.65			0.65			0.65			0.65			0.65		8.4.2
Resistance modification factor for shear, concrete failure modes [4]	R	-	0.75	1.00			1.00			1.00			1.00			1.00		D.5.3 (c)
Load bearing length of anchor in shear	ℓ_e	in. (mm)	1-1/2 (38)	1-1/2 (38)	2 (51)	2-1/2 (64)	2 (51)	2-1/2 (64)	3-1/4 (83)	2-3/4 (70)	3-1/4 (83)	4 (102)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	4 (102)	5-3/4 (146)	
Effectiveness factor for pryout	k_{cp}	-	1.0	1.0	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	

1 Design information in this table is taken from ICC-ES ESR-4266, dated December, 2020, and revised July, 2021 Tables 5 and 7, and converted for use with CSA A23.3 Annex D.
2 See Figure 1 of this document.
3 The KB-TZ2 stainless steel anchor is considered a ductile steel element as defined by CSA A23.3 Annex D section D.2.
4 For use with the load combinations of CSA A23.3 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.

Table 44 — Steel resistance for Hilti KB-TZ2 stainless steel anchors [1,2]

Nominal anchor diameter in.	Effective embedment depth in. (mm)			Tensile [3] N_{sar} lb (kN)	Shear [4] V_{sar} lb (kN)	Seismic Shear [5] $V_{sar,eq}$ lb (kN)
1/4	1-1/2 (38)			2,050 (9.1)	930 (4.1)	710 (3.2)
3/8	1-1/2 (38)			4,210 (18.7)	2,940 (13.1)	2,940 (13.1)
3/8	2 (51)	2-1/2 (64)		4,210 (18.7)	3,115 (13.9)	3,115 (13.9)
1/2	2 (51)	2-1/2 (64)	3-1/4 (83)	8,070 (35.9)	5,320 (23.7)	5,320 (23.7)
5/8	2-3/4 (70)	3-1/4 (83)	4 (102)	12,810 (57.0)	7,875 (35.0)	7,875 (35.0)
3/4	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	16,350 (72.7)	10,555 (47.0)	8,585 (38.2)
1	4 (102)			31,930 (142.0)	14,635 (65.1)	8,585 (38.2)
1	5-3/4 (146)			31,930 (142.0)	20,020 (89.1)	8,585 (38.2)

1 See Section 3.1.8 to convert factored resistance value to ASD value.
2 Hilti KB-TZ2 stainless steel anchors are to be considered ductile steel elements.
3 Tensile Nsar = Ase,N fs futa R as noted in CSA A23.3 Annex D.
4 Shear determined by static shear tests with Vsar < 0.6 Ase,V fs futa R as noted in CSA A23.3 Annex D.
5 Seismic shear values determined by seismic shear tests with Vsar,eq < 0.60 Ase,V fs futa R as noted in CSA A23.3 Annex D. See Section 3.1.8 for additional information on seismic applications.

3.3.5

Table 45 — Hilti KB-TZ2 stainless steel factored resistance based on concrete failure modes in uncracked concrete, applicable for both hammer and core drilled installations [1,2,3,4]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension - N_r				Shear - V_r			
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	1 1/2 (38)	1 3/4 (44)	810 (3.6)	885 (3.9)	950 (4.2)	1,065 (4.7)	1,535 (6.8)	1,720 (7.6)	1,880 (8.4)	2,175 (9.7)
3/8	1 1/2 (38)	1 7/8 (48)	1,535 (6.8)	1,720 (7.6)	1,880 (8.4)	2,175 (9.7)	1,535 (6.8)	1,720 (7.6)	1,880 (8.4)	2,175 (9.7)
	2 (51)	2 1/2 (64)	2,365 (10.5)	2,645 (11.8)	2,900 (12.9)	3,345 (14.9)	2,365 (10.5)	2,645 (11.8)	2,900 (12.9)	3,345 (14.9)
	2 1/2 (64)	3 (76)	2,875 (12.8)	3,125 (13.9)	3,340 (14.9)	3,715 (16.5)	6,615 (29.4)	7,395 (32.9)	8,100 (36.0)	9,355 (41.6)
1/2	2 (51)	2 1/2 (64)	2,355 (10.5)	2,610 (11.6)	2,835 (12.6)	3,240 (14.4)	2,365 (10.5)	2,645 (11.8)	2,900 (12.9)	3,345 (14.9)
	2-1/2 (64)	3 (76)	2,810 (12.5)	3,140 (14.0)	3,440 (15.3)	3,975 (17.7)	6,615 (29.4)	7,395 (32.9)	8,100 (36.0)	9,355 (41.6)
	3 1/4 (83)	3 3/4 (95)	3,855 (17.1)	4,310 (19.2)	4,720 (21.0)	5,450 (24.2)	9,805 (43.6)	10,960 (48.8)	12,005 (53.4)	13,865 (61.7)
5/8	2 3/4 (70)	3 1/4 (83)	2,860 (12.7)	3,200 (14.2)	3,505 (15.6)	4,045 (18.0)	7,630 (33.9)	8,530 (37.9)	9,345 (41.6)	10,790 (48.0)
	3 1/4 (83)	3 3/4 (95)	4,165 (18.5)	4,575 (20.3)	4,935 (22.0)	5,570 (24.8)	9,805 (43.6)	10,960 (48.8)	12,005 (53.4)	13,865 (61.7)
	4 (102)	4 1/2 (114)	5,615 (25.0)	6,235 (27.7)	6,795 (30.2)	7,775 (34.6)	13,385 (59.5)	14,965 (66.6)	16,395 (72.9)	18,930 (84.2)
3/4	3 1/4 (83)	4 (102)	4,900 (21.8)	5,480 (24.4)	6,005 (26.7)	6,930 (30.8)	9,805 (43.6)	10,960 (48.8)	12,005 (53.4)	13,865 (61.7)
	3 3/4[6] (95)	4 1/2 (114)	6,865 (30.5)	7,675 (34.1)	8,405 (37.4)	9,710 (43.2)	13,730 (61.1)	15,350 (68.3)	16,815 (74.8)	19,415 (86.4)
	4 3/4 (121)	5 1/2 (140)	8,660 (38.5)	9,685 (43.1)	10,605 (47.2)	12,250 (54.5)	17,320 (77.0)	19,365 (86.1)	21,215 (94.4)	24,495 (109.0)
1	4 (102)	4 5/8 (117)	7,560 (33.6)	8,455 (37.6)	9,260 (41.2)	10,695 (47.6)	15,125 (67.3)	16,910 (75.2)	18,525 (82.4)	21,390 (95.1)
	5 3/4 (146)	6 3/8 (162)	13,035 (58.0)	14,570 (64.8)	15,965 (71.0)	18,435 (82.0)	26,070 (116.0)	29,145 (129.6)	31,925 (142.0)	36,865 (164.0)

Table 46 — Hilti KB-TZ2 stainless steel factored resistance based on concrete failure modes in cracked concrete, applicable for both hammer and core drilled installations [1,2,3,4]

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension - N_r				Shear - V_r			
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	1 1/2 (38)	1 3/4 (44)	470 (2.1)	525 (2.3)	575 (2.6)	665 (3.0)	820 (3.6)	915 (4.1)	1,000 (4.5)	1,155 (5.1)
3/8	1 1/2 (38)	1 7/8 (48)	1,350 (6.0)	1,510 (6.7)	1,655 (7.4)	1,915 (8.5)	1,350 (6.0)	1,510 (6.7)	1,655 (7.4)	1,915 (8.5)
	2 (51)	2 1/2 (64)	2,080 (9.3)	2,330 (10.4)	2,550 (11.3)	2,945 (13.1)	2,080 (9.3)	2,330 (10.4)	2,550 (11.3)	2,945 (13.1)
	2 1/2 (64)	3 (76)	2,350 (10.4)	2,625 (11.7)	2,875 (12.8)	3,320 (14.8)	4,695 (20.9)	5,250 (23.4)	5,750 (25.6)	6,640 (29.5)
1/2	2 (51)	2 1/2 (64)	1,680 (7.5)	1,880 (8.4)	2,060 (9.2)	2,375 (10.6)	1,680 (7.5)	1,880 (8.4)	2,060 (9.2)	2,375 (10.6)
	2-1/2 (64)	3 (76)	2,910 (12.9)	3,255 (14.5)	3,565 (15.9)	4,115 (18.3)	5,820 (25.9)	6,505 (28.9)	7,130 (31.7)	8,230 (36.6)
	3 1/4[8] (83)	3 3/4 (95)	3,480 (15.5)	3,890 (17.3)	4,260 (19.0)	4,920 (21.9)	6,960 (31.0)	7,780 (34.6)	8,525 (37.9)	9,845 (43.8)
5/8	2 3/4 (70)	3 1/4 (83)	3,355 (14.9)	3,755 (16.7)	4,110 (18.3)	4,750 (21.1)	6,715 (29.9)	7,505 (33.4)	8,225 (36.6)	9,495 (42.2)
	3 1/4 (83)	3 3/4 (95)	4,315 (19.2)	4,820 (21.5)	5,285 (23.5)	6,100 (27.1)	8,625 (38.4)	9,645 (42.9)	10,565 (47.0)	12,200 (54.3)
	4 (102)	4 1/2 (114)	4,750 (21.1)	5,310 (23.6)	5,820 (25.9)	6,720 (29.9)	9,505 (42.3)	10,625 (47.3)	11,640 (51.8)	13,440 (59.8)
3/4	3 1/4 (83)	4 (102)	4,315 (19.2)	4,820 (21.5)	5,285 (23.5)	6,100 (27.1)	8,625 (38.4)	9,645 (42.9)	10,565 (47.0)	12,200 (54.3)
	3 3/4[7] (95)	4 1/2 (114)	5,345 (23.8)	5,975 (26.6)	6,545 (29.1)	7,560 (33.6)	10,690 (47.6)	11,955 (53.2)	13,095 (58.2)	15,120 (67.3)
	4 3/4 (121)	5 1/2 (140)	6,160 (27.4)	6,890 (30.6)	7,545 (33.6)	8,715 (38.8)	15,240 (67.8)	17,040 (75.8)	18,670 (83.0)	21,555 (95.9)
1	4 (102)	4 5/8 (117)	6,690 (29.8)	7,480 (33.3)	8,195 (36.5)	9,465 (42.1)	13,385 (59.5)	14,965 (66.6)	16,395 (72.9)	18,930 (84.2)
	5 3/4 (146)	6 3/8 (162)	10,150 (45.2)	11,350 (50.5)	12,430 (55.3)	14,355 (63.9)	20,300 (90.3)	22,695 (101.0)	24,865 (110.6)	28,710 (127.7)

1 See Section 3.1.8 to convert factored resistance value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 22 to 33 as necessary. Compare to the steel values in Table 43. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60.
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis}$ = 0.75. No reduction needed for seismic shear, except for the 3/4 bolts where $\alpha_{V,seis}$ = 0.81. See Section 3.1.8 for additional information on seismic applications.
6 For core drilled installations of 3/4" anchors installed at 3-3/4" effective embedment, apply a reduction factor of 0.89 to the design tension strength.
7 For core drilled installations of 3/4" anchors installed at 3-3/4" effective embedment, apply a reduction factor of 0.81 to the design tension strength.
8 Fore core drilled installations of 1/2" anchors installed at 3-1/4" effective embedment, apply a reduction factor of 0.85 to the design tension strength.

Table 47 — Hilti KB-TZ2 carbon steel factored resistance in the soffit of uncracked lightweight concrete over metal deck, applicable for both hammer and core drilled installations[1,2,3,4,5,6]

Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation per Figure 4				Installation per Figure 5			
		Min. conc. thickness [8] in. (mm)	Tension - N_r		Shear - V_r	Min. conc. thickness [8] in. (mm)	Tension - N_r		Shear - V_r
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)
1/4	1-3/4 (44)	2-1/2 (64)	835 (3.7)	905 (4.0)	1,040 (4.6)	2-1/4 (57)	670 (3.0)	725 (3.2)	715 (3.2)
3/8	1-7/8 (48)	2-1/2 (64)	1,195 (5.3)	1,310 (5.8)	865 (3.8)	2-1/4 (57)	640 (2.8)	700 (3.1)	1,510 (6.7)
	2-1/2 (64)	2-1/2 (64)	1,690 (7.5)	1,865 (8.3)	1,350 (6.0)	2-1/4 (57)	1600 (7.1)	1,765 (7.9)	1,595 (7.1)
	3 (76)	2-1/2 (64)	1,925 (8.6)	2,215 (9.9)	1,350 (6.0)	N/A	N/A	N/A	N/A
1/2	2 (51)	2-1/2 (64)	1,185 (5.3)	1,450 (6.4)	1,140 (5.1)	2-1/4 (57)	1,160 (5.2)	1,420 (6.3)	1,710 (7.6)
	2-1/2 (64)	2-1/2 (64)	1,760 (7.8)	2,090 (9.3)	1,440 (6.4)	2-1/4 (57)	1,220 (5.4)	1,445 (6.4)	2,025 (9.0)
	3-1/4 (83)	2-1/2 (64)	2,410 (10.7)	2,710 (12.1)	2,095 (9.3)	N/A	N/A	N/A	N/A
	3-3/4 (95)	2-1/2 (64)	3,030 (13.5)	3,490 (15.5)	2,700 (12.0)	3-1/4 (83)	1,710 (7.6)	1,975 (8.8)	2,210 (9.8)
5/8	3-1/4 (83)	2-1/2 (64)	2,820 (12.5)	3,455 (15.4)	2,430 (10.8)	3-1/4 (83)	1,890 (8.4)	2,315 (10.3)	2,605 (11.6)
	4-1/2 (114)	2-1/2 (64)	3,715 (16.5)	4,550 (20.2)	2,965 (13.2)	N/A	N/A	N/A	N/A
3/4	4 (102)	2-1/2 (64)	2,440 (10.9)	2,815 (12.5)	2,605 (11.6)	N/A	N/A	N/A	N/A
	4-1/2[9] (114)	3-1/4 (83)	3,085 (13.7)	3,495 (15.5)	5,015 (22.3)	N/A	N/A	N/A	N/A

3.3.5

Table 48 — Hilti KB-TZ2 carbon steel factored resistance in the soffit of cracked lightweight concrete over metal deck, applicable for both hammer and core drilled installations [1,2,3,4,5,6,7]

Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation per Figure 4				Installation per Figure 5			
		Min. conc. thickness [8] in. (mm)	Tension - N_r		Shear - V_r	Min. conc. thickness [8] in. (mm)	Tension - N_r		Shear - V_r
			f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c ≥ 20 MPa (2,900 psi) lb (kN)
1/4	1-3/4 (44)	2-1/2 (64)	250 (1.1)	290 (1.3)	1,040 (4.6)	2-1/4 (57)	195 (0.9)	230 (1.0)	715 (3.2)
3/8	1-7/8 (48)	2-1/2 (64)	1,040 (4.6)	1,270 (5.6)	865 (3.8)	2-1/4 (57)	555 (2.5)	680 (3.0)	1,510 (6.7)
	2-1/2 (64)	2-1/2 (64)	1,470 (6.5)	1,770 (7.9)	1,350 (6.0)	2-1/4 (57)	1,365 (6.1)	1,645 (7.3)	1,595 (7.1)
	3 (76)	2-1/2 (64)	1,550 (6.9)	1,735 (7.7)	1,350 (6.0)	N/A	N/A	N/A	N/A
1/2	2 (51)	2-1/2 (64)	1,055 (4.7)	1,275 (5.7)	1,140 (5.1)	2-1/4 (57)	945 (4.2)	1,160 (5.1)	1,710 (7.6)
	2-1/2 (64)	2-1/2 (64)	1,365 (6.1)	1,670 (7.4)	1,440 (6.4)	2-1/4 (57)	945 (4.2)	1,160 (5.2)	2,025 (9.0)
	3-1/4 (83)	2-1/2 (64)	2,095 (9.3)	2,545 (11.3)	2,095 (9.3)	N/A	N/A	N/A	N/A
	3-3/4 (95)	2-1/2 (64)	2,140 (9.5)	2,520 (11.2)	2,700 (12.0)	3-1/4 (83)	1,210 (5.4)	1,425 (6.3)	2,210 (9.8)
5/8	3-1/4 (83)	2-1/2 (64)	2,510 (11.2)	3,075 (13.7)	2,430 (10.8)	3-1/4 (83)	1,685 (7.5)	2,060 (9.2)	2,605 (11.6)
	4-1/2 (114)	2-1/2 (64)	2,810 (12.5)	3,440 (15.3)	2,965 (13.2)	N/A	N/A	N/A	N/A
3/4	4 (102)	2-1/2 (64)	2,135 (9.5)	2,470 (11.0)	2,605 (11.6)	N/A	N/A	N/A	N/A
	4-1/2 (114)	3-1/4 (83)	2,400 (10.7)	2,700 (12.0)	5,015 (22.3)	N/A	N/A	N/A	N/A

1 See Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{ef} (effective embedment).
4 Tabular values are lightweight concrete and no additional reduction factor is needed.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Comparison of the tabular values to the steel strength is not necessary. Tabular values control.
7 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis}$ = 0.75, except for 3/4 x 4-3/4 h_{ef} where $\alpha_{N,seis}$ = 0.73. See Section 3.1.8 for additional information on seismic applications.
8 Minimum concrete thickness over the upper flute when anchor is installed in the lower flute. See Figure 4 and 5.
9 For core drilled installations of 3/4" anchors installed at 4-1/2" nominal embedment, apply a reduction factor of 0.89 to the design tension strength of anchors installed in uncracked concrete.

Table 49 — Allowable tensile loads for Hilti KB-TZ2 carbon steel and stainless steel anchors in the face of grout-filled concrete masonry unit (CMU) walls [1,3,4,5,6]

Nominal anchor diameter	Nominal embedment		Allowable Tensile capacity at s_{cr} and c_{cr}		Spacing: Critical spacing, s_{cr}		Spacing: Minimum spacing[2], s_{min}		Spacing: Load Multiplier at s_{min}	Edge Distance: Critical edge distance, c_{cr}		Edge Distance: Minimum edge distance, c_{min}		Edge Distance: Load Multiplier at c_{min}
in.	in.	(mm)	lb	(kN)	in	(mm)	in	(mm)		in	(mm)	in	(mm)	
1/4	1-3/4	(44)	145	(0.6)	6	(152)			0.62					0.87
3/8	1-7/8	(48)	405	(1.8)	6	(152)	3	(76)	0.49					0.80
	3	(76)	590	(2.6)	10	(254)			0.58	12	(305)			0.93
1/2	2-1/2	(64)	500	(2.2)	8	(203)	4	(102)	0.59					0.94
	3-3/4	(95)	640	(2.8)	13	(330)			0.78			4	(102)	1.00
5/8	3-1/4	(83)	890	(4.0)	11	(279)	5	(127)	0.66					0.96
	4-1/2	(114)	940	(4.2)	16	(406)			0.61					0.96
3/4	4	(102)	1,245	(5.5)	13	(330)			0.49	20	(508)			0.75
	5-1/2	(140)	1,385	(6.2)	19	(483)	6	(152)	0.45					0.82

Table 50 — Allowable shear loads for Hilti KB-TZ2 carbon steel and stainless steel anchors in the face of grout-filled concrete masonry unit (CMU) walls [1,3,4,5,6]

Nominal anchor diameter	Nominal embedment		Allowable shear capacity at s_{cr} and c_{cr}		Spacing: Critical spacing, s_{cr}		Spacing: Minimum spacing, s_{min}[2]		Spacing: Load multiplier at s_{min}	Edge Distance: Critical edge distance, c_{cr}		Edge Distance: Minimum edge distance, c_{min}		Edge Distance: Perpendicular load reduction factor at c_{min}	Edge Distance: Parallel load reduction factor at c_{min}
in.	in.	(mm)	lb	(kN)	in	(mm)	in	(mm)		in	(mm)	in	(mm)		
1/4	1-3/4	(44)	320	(1.4)	6	(152)								1.00	1.00
3/8	1-7/8	(48)	585	(2.6)	6	(152)	3	(76)						0.76	0.99
	3	(76)	695	(3.1)	10	(254)				12	(305)				
1/2	2-1/2	(64)	1,045	(4.7)	8	(203)	4	(102)						0.50	0.83
	3-3/4	(95)			13	(330)			0.73			4	(102)		
5/8	3-1/4	(83)	1,735	(7.7)	11	(279)	5	(127)						0.36	0.75
	4-1/2	(114)	2,050	(9.1)	16	(406)								0.35	0.85
3/4	4	(102)	1,735	(7.7)	13	(330)				20	(508)			0.36	0.75
	5-1/2	(140)	2,050	(9.1)	19	(483)	6	(152)						0.35	0.85

1 Values valid for anchors installed in face shells of Type 1, Grade N, lightweight, medium-weight, or normal-weight concrete masonry units conforming to ASTM C90. The masonry units must be fully grouted with coarse grout conforming to 2018 and 2015 IBC Section 2103.3, 2012 IBC Section 2103.13, or 2009 IBC Section 2103.12. Mortar must comply with 2018 and 2015 IBC Section 2103.2.1, 2012 IBC Section 2103.9, or 2009 IBC Section 2103.8. Masonry compressive strength must be at least 1,500 psi at the time of anchor installation.
2 Loads tabulated are applicable to anchors spaced a critical distance of 4 times the effective embedment. The anchors may be placed at a minimum spacing, s_{min}, provided that reductions are applied to the tabulated values.
3 Anchors must be installed a minimum of 1-3/8-inches from any vertical mortar joint in accordance with Figure 6.
4 Embedment depth must be measured from the outside face of the concrete masonry unit.
5 For intermediate edge and spacing distances, allowable loads may be determined by linearly interpolating between the allowable loads at the two tabulated edge or spacing distances.
6 The tabulated allowable loads have been calculated based on a safety factor of 5.0.

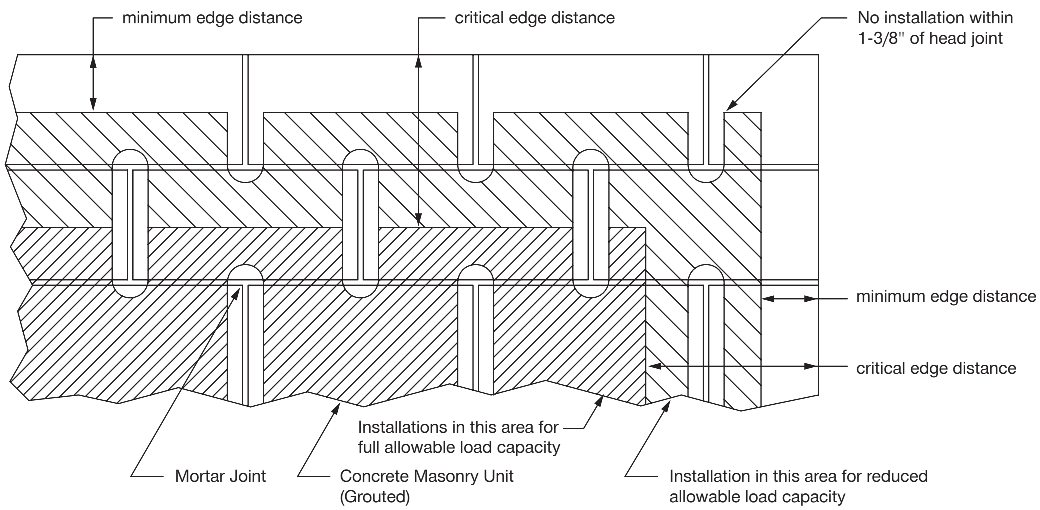
Table 51 — Allowable tensile and shear loads for Hilti KB-TZ2 carbon and stainless steel anchors in the top of grout-filled concrete masonry walls [1,3,4,5,6]

Nominal anchor diameter	Nominal embedment		Minimum edge distance from edge of wall, C_{min}		Minimum spacing,[2] s_{min}		Minimum end distance C_{end}		Allowable tensile capacity		Allowable shear capacity: Parallel to edge of masonry wall		Allowable shear capacity: Perpendicular to edge of masonry wall	
in.	in.	(mm)	in	(mm)	in	(mm)	in	(mm)	lb	(kN)	lb	(kN)	lb	(kN)
3/8	1-7/8	(48)	1-3/4	(44)	6	(152)	12	(305)	300	(1.3)	325	(1.4)	175	(0.8)
	3	(76)			10	(254)	12	(305)	395	(1.8)	475	(2.1)	220	(1.0)
1/2	2-1/2	(64)			8	(203)	12	(305)	385	(1.7)	500	(2.2)	195	(0.9)
	3-3/4	(95)			13	(330)	12	(305)	485	(2.2)	610	(2.7)	240	(1.1)
5/8	3-1/4	(83)	2-3/4	(70)	11	(279)	12	(305)	620	(2.8)	930	(4.1)	410	(1.8)
	4-1/2	(114)			16	(406)	12	(305)	865	(3.8)	1240	(5.5)	465	(2.1)

1 Values valid for anchors installed in face shells of Type 1, Grade N, lightweight, medium-weight, or normal-weight concrete masonry units conforming to ASTM C90. The masonry units must be fully grouted with coarse grout conforming to 2018 and 2015 IBC Section 2103.3, 2012 IBC Section 2103.13, or 2009 IBC Section 2103.12. Mortar must comply with 2018 and 2015 IBC Section 2103.2.1, 2012 IBC Section 2103.9, or 2009 IBC Section 2103.8. Masonry compressive strength must be at least 1,500 psi at the time of anchor installation.
2 Loads tabulated are applicable to anchors spaced a critical distance of 4 times the effective embedment. The anchors may be placed at a minimum spacing, s_{min}, provided that reductions are applied to the tabulated values.
3 Anchors must be installed a minimum of 1-3/8 inches from any head joint in accordance with Figure 6.
4 Embedment depth must be measured from the outside face of the concrete masonry unit.
5 For intermediate edge and spacing distances, allowable loads may be determined by linearly interpolating between the allowable loads at the two tabulated edge or spacing distances.
6 The tabulated allowable loads have been calculated based on a safety factor of 5.0.

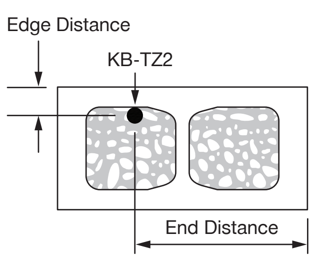
3.3.5

Figure 7 — Acceptable locations (shaded areas) for Hilti KB-TZ2 anchors in the face of grout-filled CMU walls



Anchor installation is restricted to shaded areas

Figure 8 — Edge and end distances for the Hilti KB-TZ2 anchors installed in the top of grout-filled CMU walls



INSTALLATION INSTRUCTIONS

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.hilti.com. Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

ORDERING INSTRUCTIONS

Table 52 — Hilti KB-TZ2 carbon steel product portfolio

Description	Length (in)	Length ident. letter	Thread length (in)	Nominal embed. 1 (in)	Min. fixture thickness 1 (in)	Max. fixture thickness 1 (in)	Nominal embed. 2 (in)	Min. fixture thickness 2 (in)	Max. fixture thickness 2 (in)	Nominal embed. 3 (in)	Min. fixture thickness 3 (in)	Max. fixture thickness 3 (in)	Nominal embed. 4 (in)	Min. fixture thickness 4 (in)	Max. fixture thickness 4 (in)	Package quantity
KB-TZ2 1/4 x 2-1/8	2-1/8	B	7/8	1-3/4	0	1/8	-	-	-	-	-	-	-	-	-	100
KB-TZ2 1/4 x 2-1/2	2-1/2	C	1-1/4	1-3/4	0	1/2	-	-	-	-	-	-	-	-	-	100
KB-TZ2 1/4 x 3-1/4	3-1/4	D	2	1-3/4	0	1-1/4	-	-	-	-	-	-	-	-	-	100
KB-TZ2 1/4 x 4-1/2	4-1/2	G	3	1-3/4	1/8	2-1/2	-	-	-	-	-	-	-	-	-	100
KB-TZ2 3/8 x 2-1/2	2-1/2	C	1	1-7/8	0	1/4	-	-	-	-	-	-	-	-	-	50
KB-TZ2 3/8 x 3	3	D	1 1/2	1-7/8	0	3/4	2-1/2	0	1/4	-	-	-	-	-	-	50
KB-TZ2 3/8 x 3-1/2	3-1/2	Ω	2	1-7/8	0	1-1/4	2-1/2	0	3/4	3	0	1/4	-	-	-	50
KB-TZ2 3/8 x 3-3/4	3-3/4	E	2-1/4	1-7/8	0	1-1/2	2-1/2	0	1	3	0	1/2	-	-	-	50
KB-TZ2 3/8 x 5	5	H	3-1/2	1-7/8	0	2-3/4	2-1/2	0	2-1/4	3	0	1-3/4	-	-	-	50
KB-TZ2 3/8 x 7	7	L	4-7/8	1-7/8	1/2	4-3/4	2-1/2	0	4-1/4	3	0	3-3/4	-	-	-	50
KB-TZ2 1/2 x 3	3	D	1-1/8	2	1/4	1/2	2-1/2	0	0	-	-	-	-	-	-	20
KB-TZ2 1/2 x 3-3/4	3-3/4	E	1-5/8	2	1/2	1-1/4	2-1/2	0	3/4	3	0	1/4	-	-	-	20
KB-TZ2 1/2 x 4-1/2	4-1/2	G	2-3/8	2	1/2	2	2-1/2	0	1-1/2	3	0	1	3-3/4	0	1/4	20
KB-TZ2 1/2 x 5-1/2	5-1/2	I	3-3/8	2	1/2	3	2-1/2	0	2-1/2	3	0	2	3-3/4	0	1-1/4	20
KB-TZ2 1/2 x 7	7	L	4-3/4	2	5/8	4-1/2	2-1/2	1/8	4	3	0	3-1/2	3-3/4	0	2-3/4	20
KB-TZ2 1/2 x 8-1/2	8-1/2	O	4-7/8	2	2	6	2-1/2	1-1/2	5-1/2	3	1	5	3-3/4	1/4	4-1/4	20
KB-TZ2 1/2 x 10	10	R	4-7/8	2	3-1/2	7-1/2	2-1/2	3	7	3	2-1/2	6-1/2	3-3/4	1-3/4	5-3/4	20
KB-TZ2 5/8 x 4-1/4	4-1/4	F	2-1/4	3-1/4	0	3/8	-	-	-	-	-	-	-	-	-	15
KB-TZ2 5/8 x 4-3/4	4-3/4	G	2-3/4	3-1/4	0	7/8	3-3/4	0	3/8	-	-	-	-	-	-	15
KB-TZ2 5/8 x 5-1/2	5-1/2	I	3-1/2	3-1/4	0	1-5/8	3-3/4	0	1-1/8	4-1/2	0	3/8	-	-	-	15
KB-TZ2 5/8 x 6	6	J	4	3-1/4	0	2-1/8	3-3/4	0	1-5/8	4-1/2	0	7/8	-	-	-	15
KB-TZ2 5/8 x 7	7	L	4-7/8	3-1/4	0	3-1/8	3-3/4	0	2-5/8	4-1/2	0	1-7/8	-	-	-	15
KB-TZ2 5/8 x 8-1/2	8-1/2	O	6-1/2	3-1/4	0	4-5/8	3-3/4	0	4-1/8	4-1/2	0	3-3/8	-	-	-	15
KB-TZ2 5/8 x 10	10	R	7-1/8	3-1/4	1/8	6-1/8	3-3/4	0	5-5/8	4-1/2	0	4-7/8	-	-	-	15
KB-TZ2 3/4 x 4-3/4	4-3/4	G	2-1/2	4	0	1/8	-	-	-	-	-	-	-	-	-	10
KB-TZ2 3/4 x 5-1/2	5-1/2	I	3-1/4	4	0	7/8	4-1/2	0	3/8	-	-	-	-	-	-	10
KB-TZ2 3/4 x 6-1/4	6-1/4	J	3-1/4	4	0	1-5/8	4-1/2	0	1-1/8	5-1/2	0	1/8	-	-	-	10
KB-TZ2 3/4 x 7	7	L	4	4	0	2-3/8	4-1/2	0	1-7/8	5-1/2	0	7/8	-	-	-	10
KB-TZ2 3/4 x 8	8	N	5	4	0	3-3/8	4-1/2	0	2-7/8	5-1/2	0	1-7/8	-	-	-	10
KB-TZ2 3/4 x 9	9	P	6	4	0	4-3/8	4-1/2	0	3-7/8	5-1/2	0	2-7/8	-	-	-	10
KB-TZ2 3/4 x 10	10	R	7	4	0	5-3/8	4-1/2	0	4-7/8	5-1/2	0	3-7/8	-	-	-	10
KB-TZ2 1x6-1/2	6-1/2	K	2 1/2	4 5/8	0	1-1/8	6-3/8	-	-	-	-	-	-	-	-	10
KB-TZ2 1x8	8	N	3 7/8	4 5/8	0	2-5/8	6-3/8	0	7/8	-	-	-	-	-	-	10
KB-TZ2 1x9	9	P	3 7/8	4 5/8	7/8	3-5/8	6-3/8	0	1-7/8	-	-	-	-	-	-	10
KB-TZ2 1x10-1/2	10-1/2	R	6	4 5/8	3/8	5-1/8	6-3/8	0	3-3/8	-	-	-	-	-	-	10
KB-TZ2 1x12	12	T	6	4 5/8	1-7/8	6-5/8	6-3/8	1/8	4-7/8	-	-	-	-	-	-	10

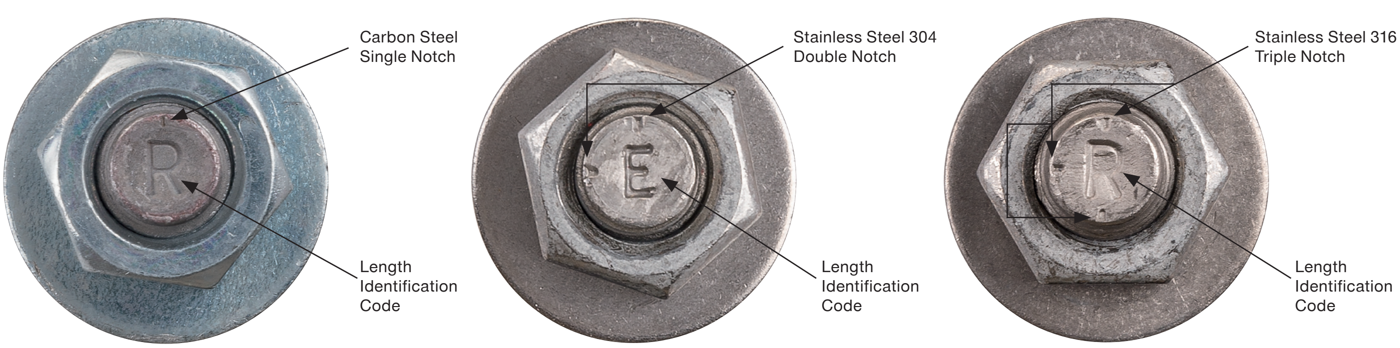
Table 53 — Hilti KB-TZ2 SS304 product portfolio

Description	Length (in)	Length ident. letter	Thread length (in)	Nominal embed. 1 (in)	Min. fixture thickness 1 (in)	Max. fixture thickness 1 (in)	Nominal embed. 2 (in)	Min. fixture thickness 2 (in)	Max. fixture thickness 2 (in)	Nominal embed. 3 (in)	Min. fixture thickness 3 (in)	Max. fixture thickness 3 (in)	Package quantity
KB-TZ2 1/4x2-1/8 SS304	2-1/8	B	7/8	1-3/4	0	1/8	-	-	-	-	-	-	100
KB-TZ2 1/4x2-1/2 SS304	2-1/2	C	1 1/4	1-3/4	0	1/2	-	-	-	-	-	-	100
KB-TZ2 1/4x3-1/4 SS304	3-1/4	D	2	1-3/4	0	1-1/4	-	-	-	-	-	-	100
KB-TZ2 1/4x4-1/2 SS304	4-1/2	G	3	1-3/4	1/8	2-1/2	-	-	-	-	-	-	100
KB-TZ2 3/8x2-1/2 SS304	2-1/2	C	1	1-7/8	0	1/4	-	-	-	-	-	-	50
KB-TZ2 3/8x3 SS304	3	D	1 1/2	1-7/8	0	3/4	2-1/2	0	1/4	-	-	-	50
KB-TZ2 3/8x3-1/2 SS304	3-1/2	Ω	2	1-7/8	0	1-1/4	2-1/2	0	3/4	3	0	1/4	50
KB-TZ2 3/8x3-3/4 SS304	3-3/4	E	2 1/4	1-7/8	0	1-1/2	2-1/2	0	1	3	0	1/2	50
KB-TZ2 3/8x5 SS304	5	H	3 1/2	1-7/8	0	2-3/4	2-1/2	0	2-1/4	3	0	1-3/4	50
KB-TZ2 3/8x7 SS304	7	L	4 7/8	1-7/8	1/2	4-3/4	2-1/2	0	4-1/4	3	0	3-3/4	50
KB-TZ2 1/2x3-3/4 SS304	3-3/4	E	1 5/8	2-1/2	0	3/4	3	0	1/4	-	-	-	20
KB-TZ2 1/2x4-1/2 SS304	4-1/2	G	2 3/8	2-1/2	0	1-1/2	3	0	1	3-3/4	0	1/4	20
KB-TZ2 1/2x5-1/2 SS304	5-1/2	I	3 3/8	2-1/2	0	2-1/2	3	0	2	3-3/4	0	1-1/4	20
KB-TZ2 1/2x7 SS304	7	L	4 3/4	2-1/2	1/8	4	3	0	3-1/2	3-3/4	0	2-3/4	20
KB-TZ2 5/8x4-1/4 SS304	4-1/4	F	2 1/4	3-1/4	0	3/8	-	-	-	-	-	-	15
KB-TZ2 5/8x4-3/4 SS304	4-3/4	G	2 3/4	3-1/4	0	7/8	3-3/4	0	3/8	-	-	-	15
KB-TZ2 5/8x6 SS304	6	J	4	3-1/4	0	2-1/8	3-3/4	0	1-5/8	4-1/2	0	7/8	15
KB-TZ2 5/8x7 SS304	7	L	4 7/8	3-1/4	0	3-1/8	3-3/4	0	2-5/8	4-1/2	0	1-7/8	15
KB-TZ2 5/8x8-1/2 SS304	8-1/2	O	6 1/2	3-1/4	0	4-5/8	3-3/4	0	4-1/8	4-1/2	0	3-3/8	15
KB-TZ2 5/8x10 SS304	10	R	7 1/8	3-1/4	1/8	6-1/8	3-3/4	0	5-5/8	4-1/2	0	4-7/8	15
KB-TZ2 3/4x4-3/4 SS304	4-3/4	G	1 3/4	4	0	1/8	-	-	-	-	-	-	10
KB-TZ2 3/4x5-1/2 SS304	5-1/2	I	2 1/2	4	0	7/8	4-1/2	0	3/8	-	-	-	10
KB-TZ2 3/4x6-1/4 SS304	6-1/4	J	3 1/4	4	0	1-5/8	4-1/2	0	1-1/8	5-1/2	0	1/8	10
KB-TZ2 3/4x7 SS304	7	L	4	4	0	2-3/8	4-1/2	0	1-7/8	5-1/2	0	7/8	10
KB-TZ2 3/4x8 SS304	8	N	5	4	0	3-3/8	4-1/2	0	2-7/8	5-1/2	0	1-7/8	10
KB-TZ2 3/4x9 SS304	9	P	6	4	0	4-3/8	4-1/2	0	3-7/8	5-1/2	0	2-7/8	10
KB-TZ2 3/4x10 SS304	10	R	7	4	0	5-3/8	4-1/2	0	4-7/8	5-1/2	0	3-7/8	10
KB-TZ2 3/4x12 SS304	12	T	7	4	1-5/8	7-3/8	4-1/2	1-1/8	6-7/8	5-1/2	1/8	5-7/8	10
KB-TZ2 1x6-1/2 SS304	6-1/2	K	2 1/2	4-5/8	0	7/8	6-3/8	-	-	-	-	-	10
KB-TZ2 1x8 SS304	8	N	3 7/8	4-5/8	0	2-3/8	6-3/8	0	7/8	-	-	-	10
KB-TZ2 1x9 SS304	9	P	3 7/8	4-5/8	1	3-3/8	6-3/8	0	1-7/8	-	-	-	10
KB-TZ2 1x10-1/2 SS304	10-1/2	R	6	4 5/8	1/2	4-7/8	6-3/8	0	3-3/8	-	-	-	10
KB-TZ2 1x12 SS304	12	T	6	4 5/8	2	6-3/8	6-3/8	1/4	4-7/8	-	-	-	10

Table 54 — Hilti KB-TZ2 SS316 product portfolio

Description	Length (in)	Length ident. letter	Thread length (in)	Nominal embed. 1 (in)	Min. fixture thickness 1 (in)	Max. fixture thickness 1 (in)	Nominal embed. 2 (in)	Min. fixture thickness 2 (in)	Max. fixture thickness 2 (in)	Nominal embed. 3 (in)	Min. fixture thickness 3 (in)	Max. fixture thickness 3 (in)	Package quantity
KB-TZ2 1/4x2-1/2 SS316	2-1/2	C	1-1/4	1-3/4	0	1/2	-	-	-	-	-	-	100
KB-TZ2 1/4x3-1/4 SS316	3-1/4	D	2	1-3/4	0	1-1/4	-	-	-	-	-	-	100
KB-TZ2 1/4x4-1/2 SS316	4-1/2	G	3	1-3/4	1/8	2-1/2	-	-	-	-	-	-	100
KB-TZ2 3/8x2-1/2 SS316	2-1/2	C	1	1-7/8	0	1/4	-	-	-	-	-	-	50
KB-TZ2 3/8x3 SS316	3	D	1-1/2	1-7/8	0	3/4	2-1/2	0	1/4	-	-	-	50
KB-TZ2 3/8x3-1/2 SS316	3-1/2	Ω	2	1-7/8	0	1-1/4	2-1/2	0	3/4	3	0	1/4	50
KB-TZ2 3/8x3-3/4 SS316	3-3/4	E	2-1/4	1-7/8	0	1-1/2	2-1/2	0	1	3	0	1/2	50
KB-TZ2 3/8x5 SS316	5	H	3-1/2	1-7/8	0	2-3/4	2-1/2	0	2-1/4	3	0	1-3/4	50
KB-TZ2 3/8x7 SS316	7	L	4-7/8	1-7/8	1/2	4-3/4	2-1/2	0	4-1/4	3	0	3-3/4	50
KB-TZ2 1/2x3-3/4 SS316	3-3/4	E	1-5/8	2-1/2	0	3/4	3	0	1/4	-	-	-	20
KB-TZ2 1/2x4-1/2 SS316	4-1/2	G	2-3/8	2-1/2	0	1-1/2	3	0	1	3-3/4	0	1/4	20
KB-TZ2 1/2x5-1/2 SS316	5-1/2	I	3-3/8	2-1/2	0	2-1/2	3	0	2	3-3/4	0	1-1/4	20
KB-TZ2 1/2x7 SS316	7	L	4-3/4	2-1/2	1/8	4	3	0	3-1/2	3-3/4	0	2-3/4	20
KB-TZ2 1/2x8-1/2 SS316	8-1/2	O	4-7/8	2-1/2	1-1/2	5-1/2	3	1	5	3-3/4	1/4	4-1/4	20
KB-TZ2 1/2x10 SS316	10	R	4-7/8	2-1/2	3	7	3	2-1/2	6-1/2	3-3/4	1-3/4	5-3/4	20
KB-TZ2 5/8x4-1/4 SS316	4-1/4	F	2-1/4	3-1/4	0	3/8	-	-	-	-	-	-	15
KB-TZ2 5/8x4-3/4 SS316	4-3/4	G	2-3/4	3-1/4	0	7/8	3-3/4	0	3/8	-	-	-	15
KB-TZ2 5/8x6 SS316	6	J	4	3-1/4	0	2-1/8	3-3/4	0	1-5/8	4-1/2	0	7/8	15
KB-TZ2 5/8x7 SS316	7	L	4-7/8	3-1/4	0	3-1/8	3-3/4	0	2-5/8	4-1/2	0	1-7/8	15
KB-TZ2 5/8x8-1/2 SS316	8-1/2	O	6-1/2	3-1/4	0	4-5/8	3-3/4	0	4-1/8	4-1/2	0	3-3/8	15
KB-TZ2 5/8x10 SS316	10	R	7-1/8	3-1/4	1/8	6-1/8	3-3/4	0	5-5/8	4-1/2	0	4-7/8	15
KB-TZ2 3/4x4-3/4 SS316	4-3/4	G	1-3/4	4	0	1/8	-	-	-	-	-	-	10
KB-TZ2 3/4x5-1/2 SS316	5-1/2	I	2-1/2	4	0	7/8	4-1/2	0	3/8	-	-	-	10
KB-TZ2 3/4x6-1/4 SS316	6-1/4	J	3-1/4	4	0	1-5/8	4-1/2	0	1-1/8	5-1/2	0	1/8	10
KB-TZ2 3/4x7 SS316	7	L	4	4	0	2-3/8	4-1/2	0	1-7/8	5-1/2	0	7/8	10
KB-TZ2 3/4x8 SS316	8	N	5	4	0	3-3/8	4-1/2	0	2-7/8	5-1/2	0	1-7/8	10
KB-TZ2 3/4x9 SS316	9	P	6	4	0	4-3/8	4-1/2	0	3-7/8	5-1/2	0	2-7/8	10
KB-TZ2 3/4x10 SS316	10	R	7	4	0	5-3/8	4-1/2	0	4-7/8	5-1/2	0	3-7/8	10
KB-TZ2 3/4x12 SS316	12	T	7	4	1-5/8	7-3/8	4-1/2	1-1/8	6-7/8	5-1/2	1/8	5-7/8	10

Figure 9 — Anchor head with length identification code and KB-TZ2 head notch embossment



UNIVERSAL STRUCTURAL BRACKET

CERTIFICATIONS

FEATURES

- Universal design allows one product to attach directly to concrete, wood, bar joist or I-beam adapters
- Integrated angle gauge easily displays brace member angle of installation
- Snap-off bolt head helps enable easy installation and inspection of seismic sway braces
- Works with 1" through 2" brace pipes to reduce inventory
- Low profile minimizes prying effect on concrete fasteners
- Meets NFPA® 13 as pre-qualified for seismic applications
- FM® Specification Tested
- FM Approved with 12 gauge or thicker Type A solid strut as brace member

SPECIFICATIONS

Finish: Electrogalvanized

Material: Steel

Table 1/2

Catalog Number	Hole Size (HS)	Width (W)	Thickness (T)	A	B	C
CSBU1	9/16"	1 15/16"	3/16"	2 1/16"	1 5/16"	1 3/8"
CSBU2	13/16"	1 15/16"	3/16"	2 1/16"	1 5/16"	1 3/8"

Catalog Number	Hole Size (HS)	Width (W)	Thickness(T)	A	B	C
CSBU58	11/16"	1 15/16"	3/16"	2 1/16"	1 5/16"	1 3/8"

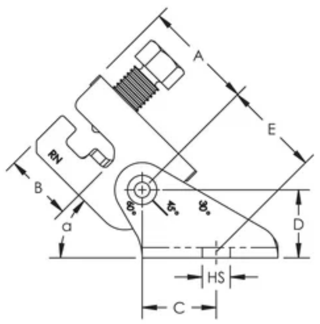
Table 2/2

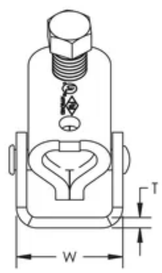
Catalog Number	D	E	UL Listed Load	Certifications
CSBU1	1 1/4"	1 3/4"	2000lb	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSBU2	1 1/4"	1 3/4"	2000lb	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSBU58	1 1/4"	1 3/4"	2000lb	FM Approved, Seismic

FM Loads

Part Number	Brace Member	Horizontal Capacity per Installation Angle from Vertical			
		30°- 44°	45°- 59°	60°- 74°	75°- 90°
CSBU1xx	Schedule 40 Pipe	1,690 lb	2,210 lb	2,660 lb	3,090 lb
	1" EMT Conduit	530 lb	911 lb	1108 lb	1223 lb
	1" Rigid Conduit	1,690 lb	2,210 lb	2,660 lb	3,090 lb
CSBU2xx	Schedule 40 Pipe	1,480 lb	2,290 lb	2,860 lb	3,090 lb
	1" EMT Conduit	530 lb	911 lb	1108 lb	1223 lb
	1" Rigid Conduit	1,480 lb	2,290 lb	2,860 lb	3,090 lb

DIAGRAMS





WARNING

nVent products shall be installed and used only as indicated in nVent's product instruction sheets and training materials. Instruction sheets are available at www.nvent.com and from your nVent customer service representative. Improper installation, misuse, misapplication or other failure to completely follow nVent's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death and/or void your warranty.

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UNIVERSAL SWAY BRACE

The nVent CADDY Universal Sway Brace is an innovative, versatile solution providing seismic bracing for suspended pipes. Featuring a unique slotted hole pattern for easy slip-on installation, installers can eliminate the risk and inconvenience of loose hardware, making it an ideal choice for ensuring safety and compliance on the job.

CERTIFICATIONS

FEATURES

- Used for both lateral and longitudinal sway brace applications
- Snap-off bolt head helps enable easy installation and inspection
- Works with 1-2 in brace pipes to reduce inventory
- Works with 12 gauge or thicker Type A solid strut as brace member
- Meets NFPA®-13 and CEN/TS 1755:2021 requirements for seismic sway bracing
- FM® Specification Tested

SPECIFICATIONS

Finish: Electrogalvanized

Material: Steel

Table 1/2

Catalog Number	Pipe Size, Nominal (Ø)	Cast Iron	Brace Pipe Size	Width (W)	A	B
CSB0100	1"		1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB0125	1 1/4"		1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB0400	4"	4"	1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB0150	1 1/2"	1 1/2"	1" - 2"	1 1/2"	3 9/16"	1 5/16"

Catalog Number	Pipe Size, Nominal (Ø)	Cast Iron	Brace Pipe Size	Width (W)	A	B
CSB0200	2"	2"	1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB0250	2 1/2"	2 1/2"	1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB0300	3"	3"	1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB0500	5"		1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB1000	10"	10"	1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB1200	12"	12"	1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB0600	6"		1" - 2"	1 1/2"	3 9/16"	1 5/16"
CSB0800	8"	8"	1" - 2"	1 1/2"	3 9/16"	1 5/16"

Table 2/2

Catalog Number	C	D	Certifications
CSB0100	5/8"	5"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB0125	11/16"	5 1/2"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB0400	11/16"	8 1/2"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB0150	3/4"	5 3/8"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB0200	13/16"	6"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB0250	15/16"	6 3/4"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB0300	1"	7 3/8"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB0500	1"	10 5/8"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB1000	1"	15 3/16"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB1200	1"	16 7/8"	OSHPD/HCAI, FM Approved, Seismic
CSB0600	1 1/8"	10 7/8"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSB0800	1 1/4"	13"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic

ADDITIONAL PRODUCT DETAILS

FM® Specification Tested for 1-1/2" to 4" pipe sizes using no hub cast iron pipe.

Load ratings for Sch 10 may also be applied to AS 1074 Medium, GB/T 3091, EN 10255 (Medium or Heavy), and JIS G3452 pipe.

Load ratings for Sch 40 may also be applied to AS 1074 Heavy, GB/T 3091, EN 10255 (Heavy), and JIS G3454 pipe.

Load ratings for FM approved lightwall may also be applied to AS 1074 Lightwall, EN 10255 L, EN 10220, and GB/T 8163 pipe.

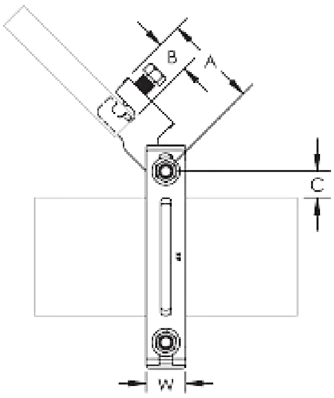
FM Approved with 12 gauge or thicker Type A solid strut as brace member

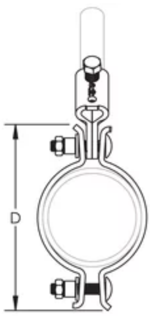
UL Loads								
Part Number	Lateral				Longitudinal			
	Sch 10/Sch 40 Service Pipe	Bull Moose Eddy Flow Service Pipe	Wheatland Mega-Flow Service Pipe	Youngstown Fire-Flo Service Pipe	Sch 10/Sch 40 Service Pipe	Bull Moose Eddy Flow Service Pipe	Wheatland Mega-Flow Service Pipe	Youngstown Fire-Flo Service Pipe
CSB0100xx	1800 lb	N/A	N/A	N/A	1000 lb	N/A	N/A	N/A
CSB0125xx	1800 lb	1800 lb	1800 lb	N/A	680 lb	680 lb	680 lb	N/A
CSB0150xx	1800 lb	1800 lb	1800 lb	1800 lb	1000 lb	1000 lb	1000 lb	1000 lb
CSB0200xx	1800 lb	1800 lb	1800 lb	1800 lb	1300 lb	1300 lb	1300 lb	1300 lb
CSB0250xx	1800 lb	1800 lb	1800 lb	1800 lb	1300 lb	1300 lb	1300 lb	1300 lb
CSB0300xx	1800 lb	1800 lb	1800 lb	1800 lb	1400 lb	1400 lb	1400 lb	1400 lb
CSB0400xx	1800 lb	1800 lb	1800 lb	1800 lb	1700 lb	1700 lb	1700 lb	1700 lb
CSB0500xx	1800 lb	N/A	N/A	N/A	1700 lb	N/A	N/A	N/A
CSB0600xx	1800 lb	N/A	1800 lb	N/A	1700 lb	N/A	1700 lb	N/A
CSB0800xx	1800 lb	N/A	N/A	N/A	1700 lb	N/A	N/A	N/A
CSB1000xx	1900 lb	N/A	N/A	N/A	1900 lb	N/A	N/A	N/A
CSB1200xx	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

FM Loads								
Part Number	Horizontal Capacity per Installation Angle from Vertical							
	Lateral				Longitudinal			
	30° - 44°	45° - 59°	60° - 74°	75° - 90°	30° - 44°	45° - 59°	60° - 74°	75° - 90°
FM Approved Lightwall, Sch 10 and Sch 40 Service Pipes								
CSB0100xx	1,490 lb	2,110 lb	2,580 lb	2,900 lb	1,290 lb	1,240 lb	1,260 lb	1,400 lb
CSB0125xx	1,380 lb	1,960 lb	2,400 lb	2,690 lb	1,290 lb	1,240 lb	1,260 lb	1,400 lb
CSB0150xx	1,380 lb	1,960 lb	2,400 lb	2,690 lb	1,200 lb	1,860 lb	2,180 lb	2,250 lb
CSB0200xx	1,380 lb	1,960 lb	2,400 lb	2,690 lb	1,200 lb	1,820 lb	2,180 lb	2,250 lb
CSB0250xx	1,440 lb	2,030 lb	2,490 lb	2,790 lb	1,320 lb	1,820 lb	2,190 lb	2,500 lb
CSB0300xx	1,390 lb	1,970 lb	2,420 lb	2,710 lb	1,300 lb	1,790 lb	2,190 lb	2,500 lb
CSB0400xx	1,390 lb	1,970 lb	2,420 lb	2,710 lb	1,300 lb	1,790 lb	2,190 lb	2,500 lb
CSB0500xx	1,390 lb	1,970 lb	2,420 lb	2,710 lb	1,300 lb	1,790 lb	2,190 lb	2,500 lb
CSB0600xx	1,460 lb	2,060 lb	2,520 lb	2,830 lb	1,410 lb	1,950 lb	2,350 lb	2,680 lb
0.188" Wall and Sch 40 Service Pipes								
CSB0800xx	1,330 lb	1,880 lb	2,300 lb	2,580 lb	1,400 lb	1,920 lb	2,350 lb	2,640 lb
CSB1000xx	1,330 lb	1,880 lb	2,300 lb	2,580 lb	1,400 lb	1,920 lb	2,350 lb	2,640 lb
CSB1200xx	1,680 lb	2,370 lb	2,910 lb	3,260 lb	1,600 lb	1,860 lb	2,240 lb	2,590 lb

FM Loads with 12 Gauge or Thicker Type A Strut as Brace Member								
Part Number	**Horizontal Capacity per Installation Angle from Vertical**							
	Lateral				**Longitudinal**			
	30° - 44°	**45° - 59°**	**60° - 74°**	**75° - 90°**	**30° - 44°**	**45° - 59°**	**60° - 74°**	**75° - 90°**
FM Approved Lightwall, Sch 10 and Sch 40 Service Pipes								
CSB0100xx	1040 lb	1470 lb	1800 lb	2010 lb	660 lb	580 lb	640 lb	-
CSB0125xx	1040 lb	1470 lb	1800 lb	2010 lb	660 lb	580 lb	640 lb	-
CSB0150xx	1580 lb	2240 lb	2740 lb	3070 lb	1320 lb	1340 lb	1620 lb	-
CSB0200xx	1580 lb	2240 lb	2740 lb	3070 lb	890 lb	1220 lb	1830 lb	-
CSB0250xx	1620 lb	2300 lb	2820 lb	3160 lb	890 lb	1220 lb	1830 lb	-
CSB0300xx	1520 lb	2160 lb	2640 lb	2960 lb	890 lb	1220 lb	1830 lb	-
CSB0400xx	1520 lb	2160 lb	2640 lb	2960 lb	1340 lb	1850 lb	2350 lb	-
CSB0500xx	1520 lb	2160 lb	2640 lb	2960 lb	1340 lb	1850 lb	2350 lb	-
CSB0600xx	1570 lb	2220 lb	2720 lb	3050 lb	1540 lb	1850 lb	2230 lb	-
0.188" Wall and Sch 40 Service Pipes								
CSB0800xx	1570 lb	2220 lb	2720 lb	3050 lb	1270 lb	1750 lb	2160 lb	-
CSB1000xx	1410 lb	2000 lb	2450 lb	2740 lb	1270 lb	1750 lb	2160 lb	-
CSB1200xx	1460 lb	2070 lb	2530 lb	2840 lb	1390 lb	1750 lb	2110 lb	-

DIAGRAMS





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QUICK GRIP LATERAL SWAY BRACE

The Quick Grip Lateral Brace, part of the nVent CADDY line of fire sprinkler bracing systems from nVent, is designed to help simplify installations when bracing service pipe for seismic or other catastrophic events. It features an innovative design for quick attachment of brace pipe to service pipe saving time and money.

CERTIFICATIONS

FEATURES

- Easy two-step installation eliminates extra trips between structure and service pipe
- Works with 1" and 1 1/4" (25 mm and 32 mm) brace pipes to reduce inventory
- Yellow tips provide a visual indicator that the bolts have been properly torqued
- Easy installation with an impact wrench from the bottom side of the clamp
- Meets NFPA®-13 requirements for seismic sway bracing
- Meets CEN/TS 17551:2021 requirements for Seismic Sway Bracing

SPECIFICATIONS

Finish: Electrogalvanized

Material: Steel

Table 1/1

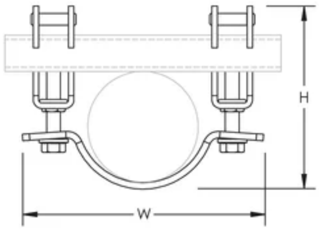
Catalog Number	Pipe Size	Width (W)	Height (H)	Certifications
CSBQG0250EG	2 1/2"	6 3/4"	5 7/16" - 5 7/8"	cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSBQG0300EG	3"	7 1/2"	6 1/8" - 6 1/2"	AON Fire Protection, Rigid Seismic, cUL, UL, OSHPD/HCAI, FM Approved, Seismic

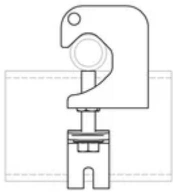
Catalog Number	Pipe Size	Width (W)	Height (H)	Certifications
CSBQG0400EG	4"	8 3/4"	7 1/8" - 7 1/2"	AON Fire Protection, Rigid Seismic, cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSBQG0600EG	6"	11 3/4"	9 1/4" - 9 5/8"	AON Fire Protection, Rigid Seismic, cUL, UL, OSHPD/HCAI, FM Approved, Seismic
CSBQG0800EG	8"	13 7/8"	11 3/8" - 11 13/16"	AON Fire Protection, Rigid Seismic, cUL, UL, OSHPD/HCAI, FM Approved, Seismic

UL Loads				
Part Number	**Lateral**			
	Sch 10/Sch 40 Service Pipe	**Bull Moose Eddy Flow Service Pipe**	**Wheatland Mega-Flow Service Pipe**	**Youngstown Fire-Flo Service Pipe**
CSBQG0250	1500 lb	1500 lb	1500 lb	1500 lb
CSBQG0300	1300 lb	1300 lb	1300 lb	1300 lb
CSBQG0400	1500 lb	1500 lb	1500 lb	1500 lb
CSBQG0500	N/A	N/A	N/A	N/A
CSBQG0600	1400 lb	N/A	1400 lb	N/A
CSBQG0800	1400 lb	N/A	N/A	N/A

FM Loads					
Part Number	**Service Pipe Schedule**	**Lateral**			
		Horizontal Capacity per Installation Angle from Vertical			
		30°- 44°	**45°- 59°**	**60°- 74°**	**75°- 90°**
CSBQG0250EG	Lightwall	1,410 lb	2,000 lb	2,450 lb	2,740 lb
	10	1,410 lb	2,000 lb	2,450 lb	2,740 lb
	40	1,410 lb	2,000 lb	2,450 lb	2,740 lb
CSBQG0300EG	Lightwall	1,190 lb	1,680 lb	2,060 lb	2,300 lb
	10	1,190 lb	1,680 lb	2,060 lb	2,300 lb
	40	1,190 lb	1,680 lb	2,060 lb	2,300 lb
CSBQG0400EG	Lightwall	1,190 lb	1,680 lb	2,060 lb	2,300 lb
	10	1,190 lb	1,680 lb	2,060 lb	2,300 lb
	40	1,190 lb	1,680 lb	2,060 lb	2,300 lb
CSBQG0600EG	Lightwall	870 lb	1,230 lb	1,510 lb	1,690 lb
	10	870 lb	1,230 lb	1,510 lb	1,690 lb
	40	970 lb	1,370 lb	1,680 lb	1,870 lb
CSBQG0800EG	0.188" (Wall Thickness)	790 lb	1,110 lb	1,360 lb	1,520 lb
	40	790 lb	1,110 lb	1,360 lb	1,520 lb

DIAGRAMS





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BRANCH LINE RESTRAINT PIPE ATTACHMENT

CERTIFICATIONS

FEATURES

- Accepts 3/8" or 1/2" (M10 or M12) threaded rod
- Quick grip clamp simplifies measuring and cutting of threaded rod
- Eliminates need to cut threaded rod to exact dimensions
- Works with rough-cut threaded rod and eliminates pipe-side deburring
- Can be installed with threaded rod above or below the service pipe
- Shear-off head helps ensure correct torque and simplifies inspection

SPECIFICATIONS

Finish: Electrogalvanized

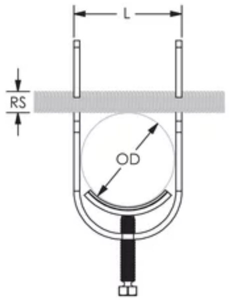
Material: Steel

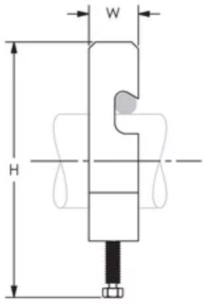
Table 1/1

Catalog Number	Pipe Size	Outer Diameter (OD)	Rod Size (RS)	Width (W)	Height (H)	Length (L)
CSBBRP0100EG	1"	1.32"	3/8", 1/2"	0.88"	2.9"	1.63"
CSBBRP0125EG	1 1/4"	1.66"	3/8", 1/2"	0.88"	3 1/4"	1.97"
CSBBRP0150EG	1 1/2"	1.9"	3/8", 1/2"	0.88"	3 1/2"	2.21"

Catalog Number	Pipe Size	Outer Diameter (OD)	Rod Size(RS)	Width (W)	Height (H)	Length (L)
CSBBRP0200EG	2"	2.38"	3/8", 1/2"	0.88"	3.95"	2.69"

DIAGRAMS





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BRANCH LINE RESTRAINT STRUCTURE ATTACHMENT TO STEEL

CERTIFICATIONS

FEATURES

Swivel barrel nut accepts 3/8" or 1/2" (M10 or M12) threaded rod

Attaches to steel members with self-drilling/tapping screw

SPECIFICATIONS

Table 1/2

Catalog Number	Material	Finish	Rod Size (RS)	Flange Thickness (FT)	Width (W)	Height (H)
CSBBRS1EG	Steel	Electrogalvanized	3/8", 1/2"	0.1000" - 1/2"	1.06"	1.11"

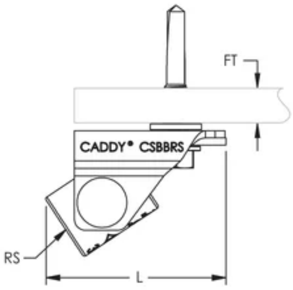
Table 2/2

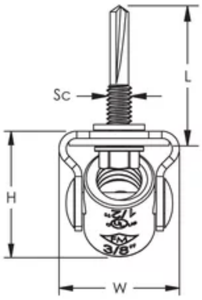
Catalog Number	Length (L)	Screw Diameter (Sc)	Screw Length (L)
CSBBRS1EG	1.59"	12"	1 1/4"

ADDITIONAL PRODUCT DETAILS

Branch line structural attachments are for restraint only and not for the hanging of fire sprinkler piping.

DIAGRAMS





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BRANCH LINE RESTRAINT STRUCTURE ATTACHMENT TO WOOD/CONCRETE

CERTIFICATIONS

FEATURES

Swivel barrel nut accepts 3/8" or 1/2" (M10 or M12) threaded rod

Attaches to wood or concrete where cracked concrete approval is not needed

SPECIFICATIONS

Table 1/2

Catalog Number	Material	Finish	Rod Size (RS)	Width (W)	Height (H)	Length (L)
CSBBRS2EG	Steel	Electrogalvanized	3/8", 1/2"	1.06"	1.11"	1.59"

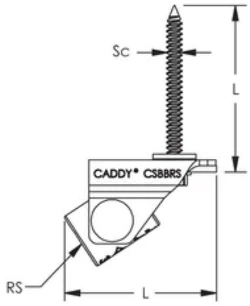
Table 2/2

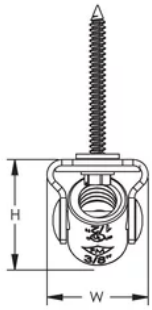
Catalog Number	Screw Diameter (Sc)	Screw Length (L)	Drill Bit Diameter
CSBBRS2EG	1/4"	1 3/4"	3/16"

ADDITIONAL PRODUCT DETAILS

Branch line structural attachments are for restraint only and not for the hanging of fire sprinkler piping.

DIAGRAMS





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BRANCH LINE RESTRAINT STRUCTURE ATTACHMENT TO THREADED HOLE

CERTIFICATIONS

FEATURES

Swivel barrel nut accepts 3/8" or 1/2" (M10 or M12) threaded rod

Attaches to concrete anchors or structural attachments with female threads

Can be used for bolting through steel

SPECIFICATIONS

Table 1/2

Catalog Number	Material	Finish	Rod Size (RS)	Width (W)	Height (H)	Length (L)
CSBBRS3EG	Steel	Electrogalvanized	3/8", 1/2"	1.06"	1.11"	1.59"

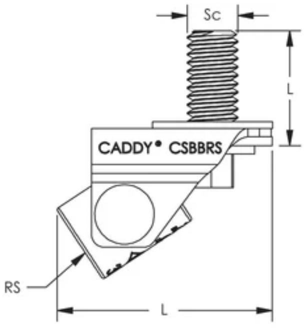
Table 2/2

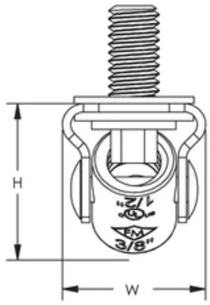
Catalog Number	Screw Diameter (Sc)	Screw Length (L)
CSBBRS3EG	3/8"	3/4"

ADDITIONAL PRODUCT DETAILS

Branch line structural attachments are for restraint only and not for the hanging of fire sprinkler piping.

DIAGRAMS





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SECTION 4

Valves & Accessories

BRASS BALL VALVES
600# THREADED FULL PORT

Function:
Used in the trim assembly of alarm check, dry pipe and automatic water control valves. Used to manually control the flow of water to small, open-head extinguishing systems and as a zone control valve.

Regularly Furnished:
Forged brass body. Cadmium plated vinyl insulated handle. Chrome plated brass ball with nylon seat. Female NPT inlet and outlet.
Size as selected by item number.

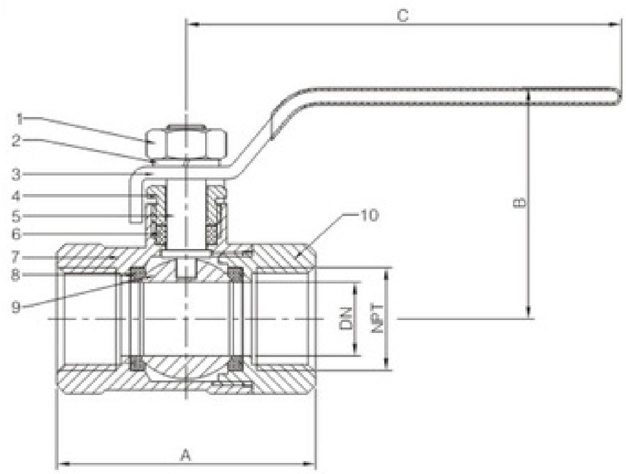
Material: Forged Brass

Maximum Working Pressure: 600 psi

Available Sizes: 1/4" through 4"

Threaded Female IPS
Threads comply with ANSIB1.20.1

CERTIFICATIONS/LISTINGS



ITEM #	Nominal Size	A	B	C	Inner Box	Master Box
6520400UL	1/4"	1.70"	1.71"	3.46"	15	120
6520401UL	3/8"	1.70"	1.71"	3.46"	15	20
6520402UL	1/2"	2.07"	1.85"	3.46"	15	120
6520403UL	3/4"	2.38"	2.13"	4.33"	10	60
6520404UL	1"	2.89"	2.28"	5.51"	8	48
6520405UL	1-1/4"	3.27"	2.80"	5.51"	4	24
6520406UL	1-1/2"	3.62"	2.99"	5.51"	2	24
6520407UL	2"	4.01"	3.27"	5.51"	2	12
6520408	2-1/2"	5.35"	4.59"	9.06"	2	6
6520409	3"	5.83"	4.86"	9.06"	2	4
6520410	4"	7.28"	5.67"	10.0"	1	2

NO.	PART	SPECIFICATION
1	Nut	Steel
2	Lock Washer	Steel
3	Handle	Steel
4	Gland Nut	ASTM B124
5	Stem	ASTM B124
6	Stem Packing	PTFE
7	Body	ASTM B124
8	Seat Ring	PTFE
9	Ball	ASTM Chrome Plated
10	Bonnet	ASTM B124

Call Argco for current listings and approvals. Dimensions are subject to manufacturer's tolerance and may change without notice.
Argco assumes no responsibility for use of void or superceded data.
Please visit argco.com for most current specifications.

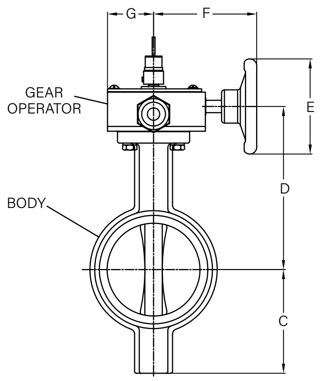
System No.		Location		Spec Section		Paragraph	
Submitted By		Date		Approved		Date	

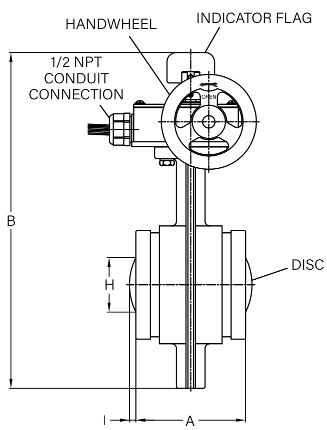
LV LANSDALE® VALVE MANUFACTURING CORP.

GROOVED BUTTERFLY VALVE

MODEL LVBG1 2" – 8"
MODEL LVBG3 10" – 12"

c UL us LISTED EX15837 | FM APPROVED | CAL FIRE LISTING No. 7770-2326:0500





DESCRIPTION:

The Lansdale grooved butterfly valve is an NFPA compliant valve designed and manufactured for the Fire Protection industry and used as a control or isolation valve within the fire protection system.

FEATURES:

- Model LVBG1 Rated 300 PSI
- Model LVBG3 Rated 175 PSI
- Indoor/Outdoor use
- Prewired double tamper switches/Normally Open
- Available Normally Closed
- Eliminates water hammer
- Slow open/slow close
- Flag type position indicator
- DI body encapsulated with a resistant durable polymer coating to ensure a long service life
- Disc is EPDM coated with SS stem

INSTALLATION:

See Lansdale's Installation & Maintenance Manual for electrical schematics.

DIMENSIONAL DATA (In.)

NOMINAL VALVE SIZE (In.) (DN)	PIPE OD	A	B	C	D	E	F	G	H	I	WT (Lbs.)
2	2.37	3.8	10.63	2.85	4.90	4.92	4.28	1.99	0	0	9.6
2-1/2	2.88	3.8	11.72	3.35	5.5	4.92	4.28	1.99	0	0	11.24
3	3.5	3.8	12.22	3.58	5.76	4.92	4.28	1.99	0	0	12.57
4	4.5	4.54	13.92	4.29	6.75	4.92	4.28	1.99	0	0	15.65
5	5.56	5.21	16.0	5.16	7.93	5.91	5.79	2.44	0	0	25.8
6	6.63	5.21	17.01	5.71	8.44	5.91	5.79	2.44	0	0	29.32
8	8.63	5.8	19.02	6.69	9.29	8.86	5.79	2.44	5.07	0.95	49.6
10	10.75	6.26	22.46	7.68	11.1	8.86	8.19	2.91	7.21	1.65	73.41
12	12.75	6.5	25.39	9.5	12.2	8.86	8.19	2.91	9.96	2.7	89.29

MATERIAL LIST

NO.	DESCRIPTION	MATERIAL	SPECIFICATION
1	Body	Nylon-11 Coated	ASTM A536
2	Disc	EPDM Encapasulated	ASTM A536
3	Stem	Ductile Iron	ASTM A536
4	Signal & Gearbox	Ductile Iron	AISI410
5	Handwheel	Ductile Iron	ASTM A536
6	O-ring	EPDM	ASTM A536

PROJECT	APPROVAL STAMP
PROJECT:	☐ APPROVED
ADDRESS:	☐ APPROVED AS NOTED
ENGINEER:	☐ NOT APPROVED
SUBMITTAL DATA:	REMARKS:
NOTES 1:	
NOTES 2:	

LANSDALE® VALVE MANUFACTURING CORP.

GROOVED SWING CHECK VALVE

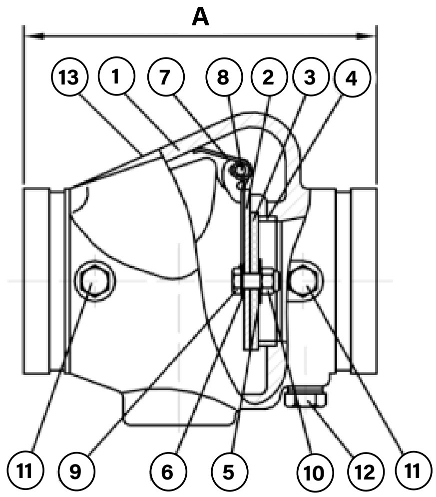
MODEL LVCVGG

EXZ6984

APPROVED

FEATURES:

- Installed in both Horizontal or Vertical Line with upward Flow
- Easier and faster to maintain and install
- Low pressure drop
- EPDM non-stick leak tight sealing
- All stainless steel wetted parts to provide superior corrosion resistance
- Fusion bonded coating of interior and exterior meet or exceed all applicable AWWA C550 standard
- 350 PSI 1¼”, 1½”, 2”, 2½”, 3”, 4”, 6”, 8”
- 300 PSI 5”, 10”, 12”
- UL/ULC Listed / FM Approved



MATERIAL SPECIFICATION		
PART NUMBER	PART	SPECIFICATION
1	Body	Ductile Iron ASTM A395
2	Clapper	Stainless Steel 304
3	Facing Seal	EPDM Rubber
4	Seat	Bronze
5	Clamping Ring	Stainless Steel 304
6	Gasket	EPDM Rubber
7	Spring	Stainless Steel 304
8	Hinge Pin	Stainless Steel 304
9	Bolt	Stainless Steel 304
10	Locknut	Stainless Steel 304
11	Plug 1/4” NPT	Carbon Steel
12	Plug 1/2” NPT	Carbon Steel
13	Nameplate	Stainless Steel

DIMENSIONS											
SIZE (IN)	1-1/4	1-1/2	2	2.5	3	4	5	6	8	10	12
L	6.3	6.3	6.7	7.2	7.8	8.6	10.5	10.6	12.8	17.0	19.5
H	2.5	2.5	2.5	3.0	3.5	4.0	4.5	5.5	6.5	8.0	8.5

PROJECT	APPROVAL STAMP
PROJECT:	☐ APPROVED
ADDRESS:	☐ APPROVED AS NOTED
ENGINEER:	☐ NOT APPROVED
SUBMITTAL DATA:	REMARKS:
NOTES 1:	
NOTES 2:	

Engineering Specification

Job Name ______	Contractor ______
Job Location ______	Approval ______
Engineer ______	Contractor's P.O. No. ______
Approval ______	Representative ______

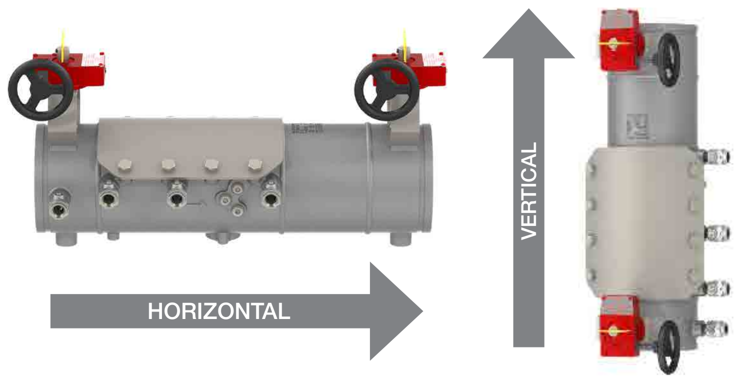
LEAD FREE*

Deringer™ 20

Double Check Valve Assembly

2"– 8"

The Deringer™ 20 Double Check Valve assembly is designed to prevent non-health hazard pollutants from entering the potable water supply system caused by backpressure and/or backsiphonage conditions.



Approved for Fire Protection, Waterworks, Plumbing, and Irrigation Applications

Features

- Integral shutoff valves designed for indoor or outdoor application
- 100% stainless steel housing
- Tamper-resistant test cocks
- Patented Dual-action™ check modules
  - Poppet action at low flow
  - Swing action at high flow
- Silicone elastomer check discs
- Prewired supervisory switches
- Flange adapters available
- IPS grooved ends

Specification

Deringer 20 Double Check valve shall use two independent Dual-action check modules and two integral resiliently seated shut-off valves, all of which shall be contained within a single rigid valve housing constructed entirely of 304 stainless steel. Both integral shutoff valves shall include pre-wired supervisory tamper switches contained within a weatherproof actuator housing approved for both indoor and outdoor use. Dual-action check modules shall operate as a "poppet style" check under low flow conditions, operate as a "swing style" check under high flow conditions, and use replaceable silicone elastomer sealing discs. Assembly test cocks shall be handle-less and operate through a tamper resistant actuator. The assembly shall have a single full access service port and cover with an in-line replaceable elastomer seal. The assembly shall be serviceable without special tools and approved for both horizontal and vertical applications.

Materials

Valve Housing:	304 Stainless Steel
Valve Cover:	304 Stainless Steel
SOV Disks:	EPDM/304SS
SOV Shafts:	304 Stainless Steel
SOV Bearings:	PTFE Fluoropolymer/Bronze
Non-wetted Bolts:	Grade 8 Zinc Plated
Check Disks:	Silicone (NSF)
Wetted Fasteners:	18-8 Stainless Steel
Check Springs:	17-7 Stainless Steel
Check Pins:	17-7/18-8 Stainless Steel
Check Seats:	Noryl® Polymer (NSF)
O-rings:	Buna-N (NSF)

Pressure — Temperature

Temperature Range: 33°F – 140°F

Working Pressure: 10 – 175 psi

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

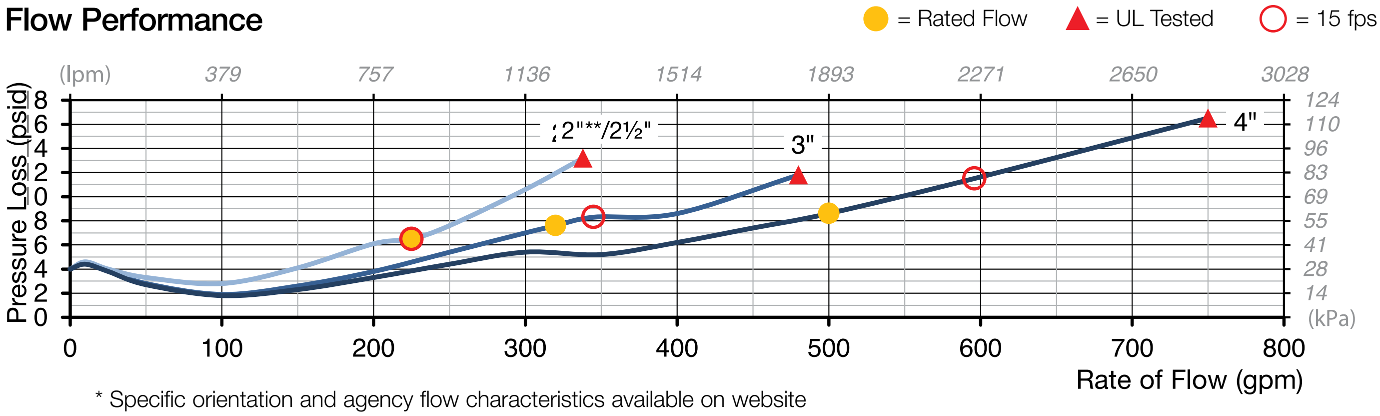
*The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.

Noryl is a registered trademark of SHPP Global Technologies B.V.

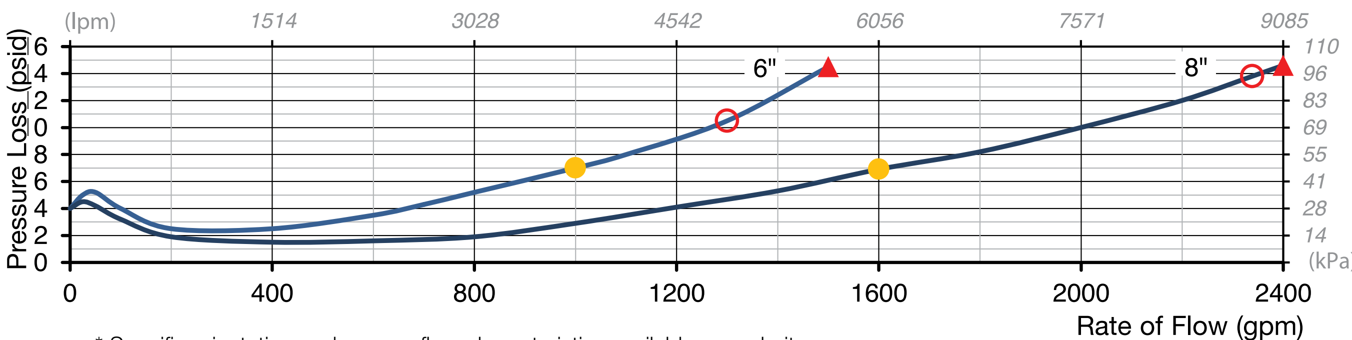
AMES FIRE & WATERWORKS

A WATTS Brand

Flow Performance



* Specific orientation and agency flow characteristics available on website



* Specific orientation and agency flow characteristics available on website

Standards

AWWA C510-07 Compliant

ANSI/NSF/CAN 61
UL Certified Health Effects

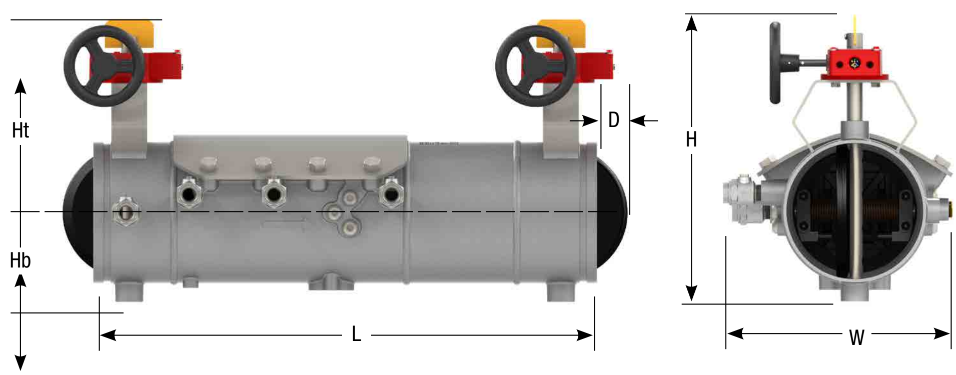
UL Certified to ANSI/NSF/CAN 372
LEAD FREE

End Connections
- IPS Groove for Steel Pipe: AWWA C606
- Flange Adapters: ANSI B16.1 Class 125

CLASSIFIED C UL US
WATER QUALITY
[MH64212]
ANSI/NSF/CAN 61
ANSI/NSF/CAN 372
5NS5

FM APPROVED
USC APPROVED
ASSE 1015

Dimensions — Weights



Size	Model	Ht		Hb		L		D		H		W		Weight	
in.		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lb	kg
2 (2½)**	20	7.1	180	2.9	74	22.3	566	0.0	0	10.0	254	11.0	279	52	24
2½	20	7.1	180	2.9	74	18.7	475	0.0	0	10.0	254	11.0	279	38	17
3	20	7.4	188	2.9	74	18.7	475	0.0	0	10.3	262	11.0	279	40	18
4	20	7.9	201	2.9	74	18.7	475	0.2	5	10.3	262	11.0	279	42	19
6	20	10.1	257	4.5	114	25	726	1.0	25	14.6	370	13.8	351	90	41
8	20	10.4	264	5.4	137	30.7	780	1.8	46	15.8	401	13.8	351	141	64

**2" size uses a 2½" assembly with 2½" groove to 2" female NPT adapter and couplings. Adapter and couplings ship unassembled.

AMES FIRE & WATERWORKS
A WATTS Brand

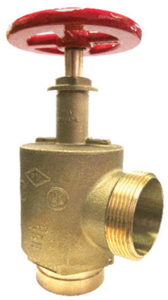
USA: Backflow T: (978) 689-6066 • F: (978) 975-8350 • AmesFireWater.com
USA: Control Valves T: (713) 943-0688 • F: (713) 944-9445 • AmesFireWater.com
Canada: T: (888) 208-8927 • F: (905) 481-2316 • AmesFireWater.ca
Latin America: T: (52) 55-4122-0138 • AmesFireWater.com

LANSDALE® VALVE MANUFACTURING CORP.

ANGLE HOSE VALVE

MODEL LHV

EX27402



a/af*

2-1/2 GROOVED INLET x NST; NYCC; FDNY

b/bf*

2-1/2 NPT x MNST, NYCC, NDNY, FNST, MPHX, MTEMPE

c/cf*

1-1/2 NPT x MNST, or FNST

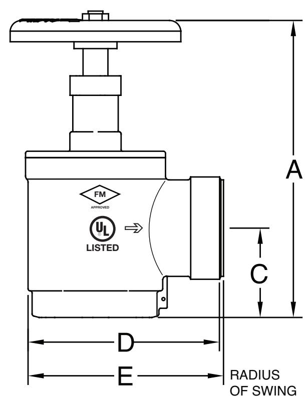
Lansdale Angle Hose Valves feature all brass construction with cast bodies for rigidity and light weight. Rated to 300 lbs. These valves can be used with a Fire Hose Rack Assembly or as a Fire Department Connection outlet.

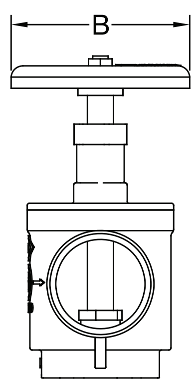
FEATURES:

- **Sizes:** 1-1/2", 2-1/2"
- **Maximum Inlet Pressure:** 300 psi
- **Inlet Connection:** FNPT or Grooved
- **Outlet Connection:** Male Hose, FNPT, Special Thread (optional)

MATERIAL

- **Valve Body:** Brass C37700
- **O-Rings:** EPDM (A70)
- **Handwheel:** Aluminum A03600
- **Handwheel Bolt:** Brass C37700
- **Handwheel Washer:** 304 Stainless Steel





*female outlet

DIMENSIONS & WEIGHTS							
TYPE	A OPEN	A CLOSED	B (IN)	C (IN)	D (IN)	E (IN)	WEIGHT (LBS)
a	11-1/2	9-7/8	5	3-5/8	3-1/8	na	9
af*	11-1/2	9-7/8	5	3-5/8	3-3/8	na	9
b	10-5/8	8-7/8	5	2-3/4	3-1/8	3-1/2	8
bf*	10-5/8	8-7/8	5	2-3/4	3-3/8	3-3/4	8
c	7-3/4	6-3/4	4	2	2-1/2	2-3/4	4
cf*	7-3/4	6-3/4	4-1/8	2	2-5/8	2-7/8	4

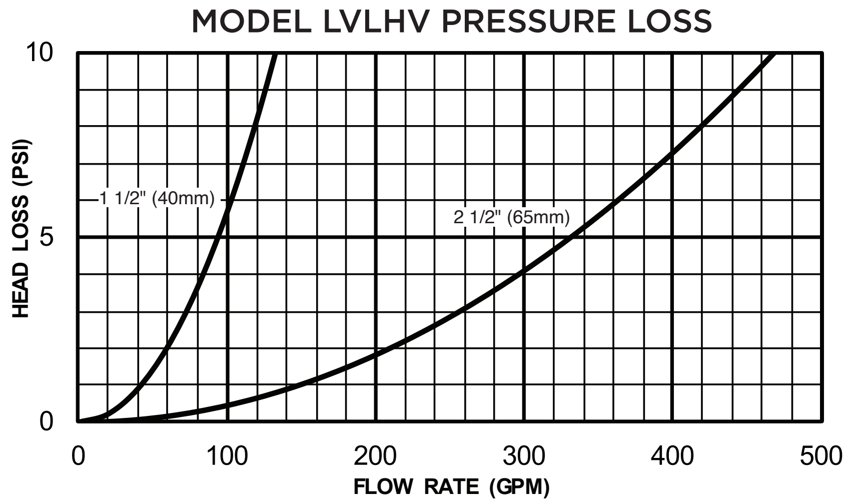
PROJECT	APPROVAL STAMP
PROJECT:	☐ APPROVED
ADDRESS:	☐ APPROVED AS NOTED
ENGINEER:	☐ NOT APPROVED
SUBMITTAL DATA:	REMARKS:
NOTES 1:	
NOTES 2:	

ANGLE HOSE VALVE

MODEL LVLHV

EX7402

Flow Characteristic



PROJECT	APPROVAL STAMP
PROJECT:	☐ APPROVED
ADDRESS:	☐ APPROVED AS NOTED
ENGINEER:	☐ NOT APPROVED
SUBMITTAL DATA:	REMARKS:
NOTES 1:	
NOTES 2:	

CAP & CHAIN
MODEL LVCNC

LANSDALE VALVE & MANUFACTURING
www.LansdaleValve.com

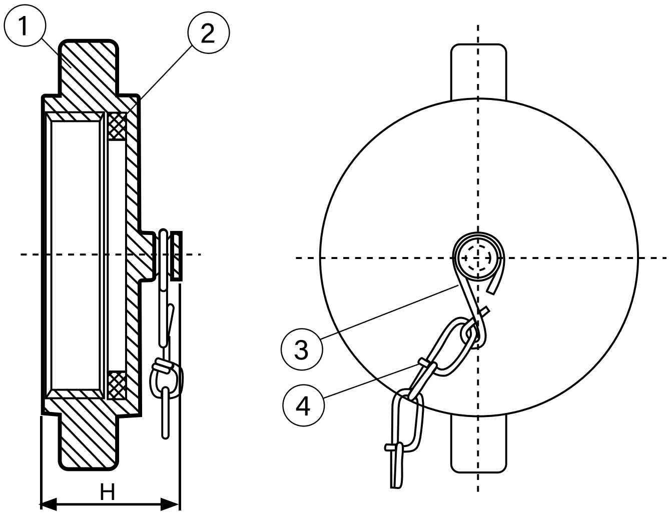
FEATURES:

Used to protect male outlet threads on valves and hydrants.

OPTIONAL FINISHES:

- RB-Rough Brass
- PB-Polished Brass
- RC-Rough Chrome Plated
- PC-Polished Chrome Plated
- Specify Thread

DIMENSIONS			
SIZE	1½"	2½"	3"
H	1.38"	1.51"	1.72"



MATERIAL LIST		
NUMBER	DESCRIPTION	MATERIAL
1	Cap	1½": ASTM B584 C85700 2½", 3": ASTM B124 C37700
2	Rubber Facing	Vulcanized Rubber
3	Snap Ring	Brass
4	Chain	Brass

PROJECT	APPROVAL STAMP
PROJECT:	☐ APPROVED
ADDRESS:	☐ APPROVED AS NOTED
ENGINEER:	☐ NOT APPROVED
SUBMITTAL DATA:	REMARKS:
NOTES 1:	
NOTES 2:	

Revision: 4/2020

Victaulic® Series UMC
Universal Manifold Check Assembly

1.0 PRODUCT DESCRIPTION

Available Sizes

- 1 ¼ – 8"/DN32 – DN200

Maximum Working Pressure

- Up to 300 psi/2068 kPa/20.6 bar

Application

- Floor control assemblies may be utilized to meet the zone separation requirements of multistory applications exceeding two stories in height or whenever separate control or zoning is specified.
- Shotgun riser assemblies may be utilized in vertical orientations on individual system risers.

Configurations

- Optional control valve: Series 705 Butterfly Valve or Series 728 Ball Valve
- Factory assembled right-handed/left-handed (field changeable if necessary)

Included Components

- Integrated Check Valve
- Series UTD (Universal Test Drain) with integrated Series ARV (Adjustable Relief Valve)
- Quick Drain Hose
- Vane Type Flow Switch
- 1 ¼ – 2"/DN32 – DN50 UMC use saddle type 2" VSR flow switch
- 2 ½ – 3"/73mm – DN80 and 8"/DN200 UMC use saddle type VSR flow switch for corresponding valve size
- 4 – 6"/DN100-DN150 UMC use VSR-M flow switch with flange adapter
- 1 ¼ – 8"/DN32 – DN200 System-side pressure gauge 400 psi/2750 kPa/27.5 bar
- 1 ¼ – 3"/DN32-DN80 supply side ½" plugged port located on control valve (if using as a system riser, pressure gauge ordered separately)
- 4 – 8"/DN100 – DN200 Supply-side pressure gauge 400 psi/2750 kPa/27.5 bar

Available End Connections

- Victaulic Original Groove System (OGS) standard groove

2.0 CERTIFICATION/LISTINGS

c UL us LISTED · FM APPROVED · CE · UK CA

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

3.0 SPECIFICATIONS – MATERIAL

Body: Ductile iron conforming to ASTM A536, grade 65-45-12

Clapper: Stainless Steel

Clapper Seal: EPDM

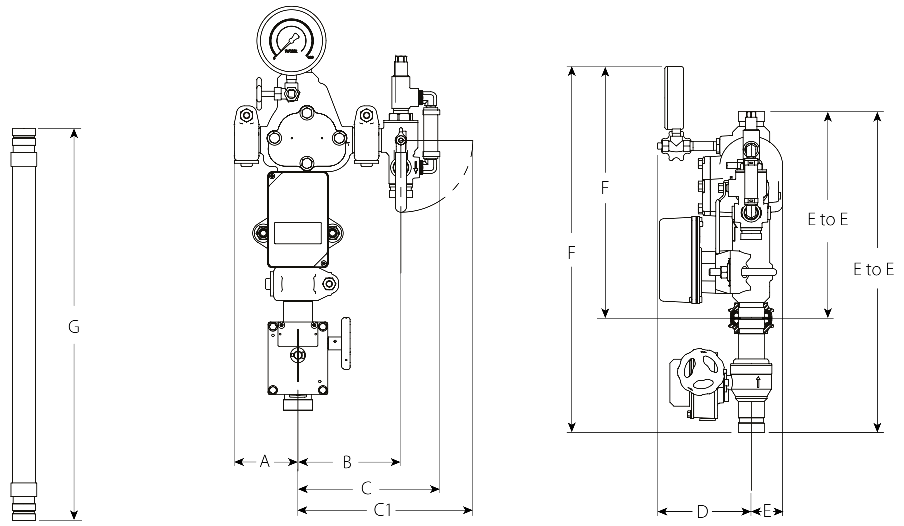
Shafts: Stainless Steel

Seat: Brass

Spring: Stainless Steel

Hose: Stainless Steel

4.0 DIMENSIONS

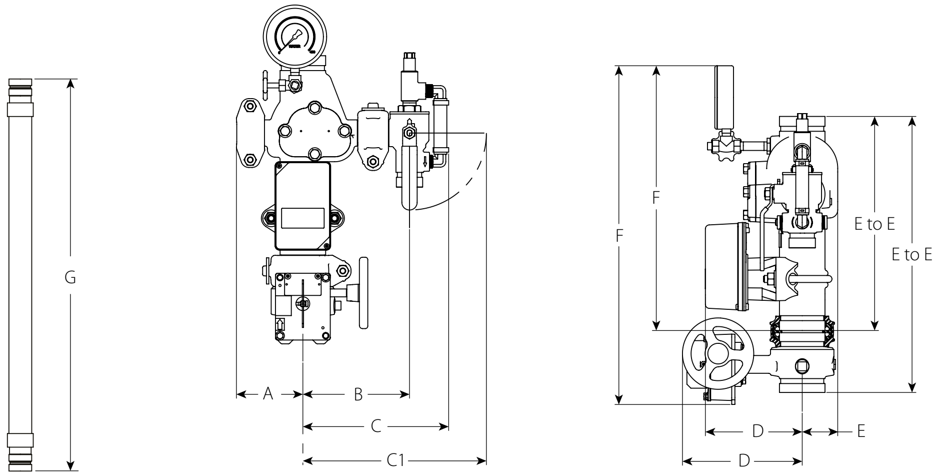


Size		Dimensions														Weight	
Nominal	Actual Outside Dia.	E to E with control valve	E to E without control valve	A	B	C	C-1	D with control valve	D without control valve	E	F with control valve	F without control valve	Series UTD Valve Size (Nominal)	Series UTD Test Orifice	G Quick Drain Hose Length	Approx. (Each) with control valve	Approx. (Each) without control valve
inches DN	inches mm	inches mm											inches DN	K-Factor S.I.	inches mm	lb kg	lb kg
1 ¼ DN32	1.660 42.4	20.50 521	13.13 333	3.63 92	5.88 149	8.25 210	10.00 254	6.00 152	6.00 152	2.00 51	23.38 594	16.00 406	1.00 25	2.8 4.0	24.00 610	32.0 14.5	24.0 10.9
1 ½ DN40	1.900 48.3	20.50 521	13.13 333	3.63 92	5.88 149	8.25 210	10.00 254	6.00 152	6.00 152	2.00 51	23.50 597	16.13 410	1.00 25	2.8 4.0	24.00 610	34.0 15.4	25.0 11.3

NOTES

- When Series UTD Valve Size (Nominal) is 1"/25 mm, flexible drain hose connection utilizes FireLock IGS™ groove profile
- ½" system supply pressure gauge port located on the control valve for sizes 1 ¼ – 1 ½"/DN32 – DN40

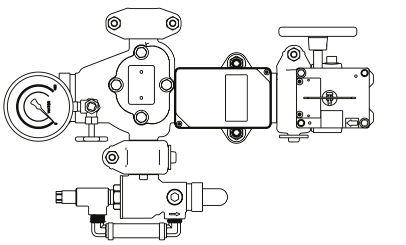
4.0 DIMENSIONS (CONTINUED)



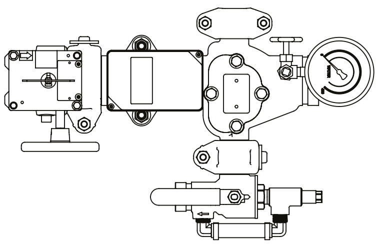
Size		Dimensions														Weight	
Nominal	Actual Outside Dia.	E to E with control valve	E to E without control valve	A	B	C	C-1	D with control valve	D without control valve	E	F with control valve	F without control valve	Series UTD Valve Size (Nominal)	Series UTD Test Orifice	G Quick Drain Hose Length	Approx. (Each) with control valve	Approx. (Each) without control valve
inches DN	inches mm	inches mm											inches DN	K-Factor S.I.	inches mm	lb kg	lb kg
2 DN50	2.375 60.3	17.50 445	13.13 333	3.63 92	5.88 149	8.25 210	10.00 254	6.38 162	6.00 152	2.00 51	21.13 537	16.38 416	1.00 25	2.8 4.0	24.00 610	36.0 16.3	25.0 11.3
2½	2.875 73.0	17.38 441	13.50 343	4.25 108	6.75 171	9.25 235	11.50 292	7.50 191	6.13 156	2.25 57	21.25 540	16.63 422	1.25 32	4.2 6.1	24.00 610	39.0 17.7	28.0 12.7
DN65	3.000 76.1	17.38 441	13.50 343	4.25 108	6.75 171	9.25 235	11.50 292	7.50 191	6.13 156	2.25 57	21.25 540	16.63 422	1.25 32	4.2 6.1	24.00 610	39.0 17.7	28.0 12.7
3 DN80	3.500 88.9	17.63 448	13.75 349	4.38 111	7.13 181	9.63 244	11.88 302	7.75 197	6.38 162	2.38 60	21.13 537	16.50 419	1.25 32	4.2 6.1	24.00 610	44.0 20.0	31.0 14.1
4 DN100	4.500 114.3	19.50 495	14.63 371	5.75 146	8.75 222	11.63 295	14.88 378	8.75 222	7.00 178	3.00 76	22.75 578	17.63 448	2.00 51	5.6 8.1	36.00 914	65.0 29.5	52.0 23.6
	6.500 165.1	23.50 597	17.38 441	6.88 175	10.00 254	12.88 327	16.13 410	11.38 289	8.00 203	3.88 98	25.88 657	19.75 502	2.00 51	5.6 8.1	36.00 914	100.0 45.4	73.0 33.1
6 DN150	6.625 168.3	23.50 597	17.38 441	6.88 175	10.00 254	12.88 327	16.13 410	11.38 289	8.00 203	3.88 98	25.88 657	19.75 502	2.00 51	5.6 8.1	36.00 914	100.0 45.4	73.0 33.1

NOTES

- ½" system supply pressure gauge port located on the control valve for sizes 2 – 3"/DN50 – DN80 (gauge sold separately)
- Included System supply pressure gauge located on the control valve for sizes 4 – 6"/DN100 – DN150
- When Series UTD Valve Size (Nominal) is 1"/25 mm, flexible drain hose connection utilizes FireLock IGS™ groove profile

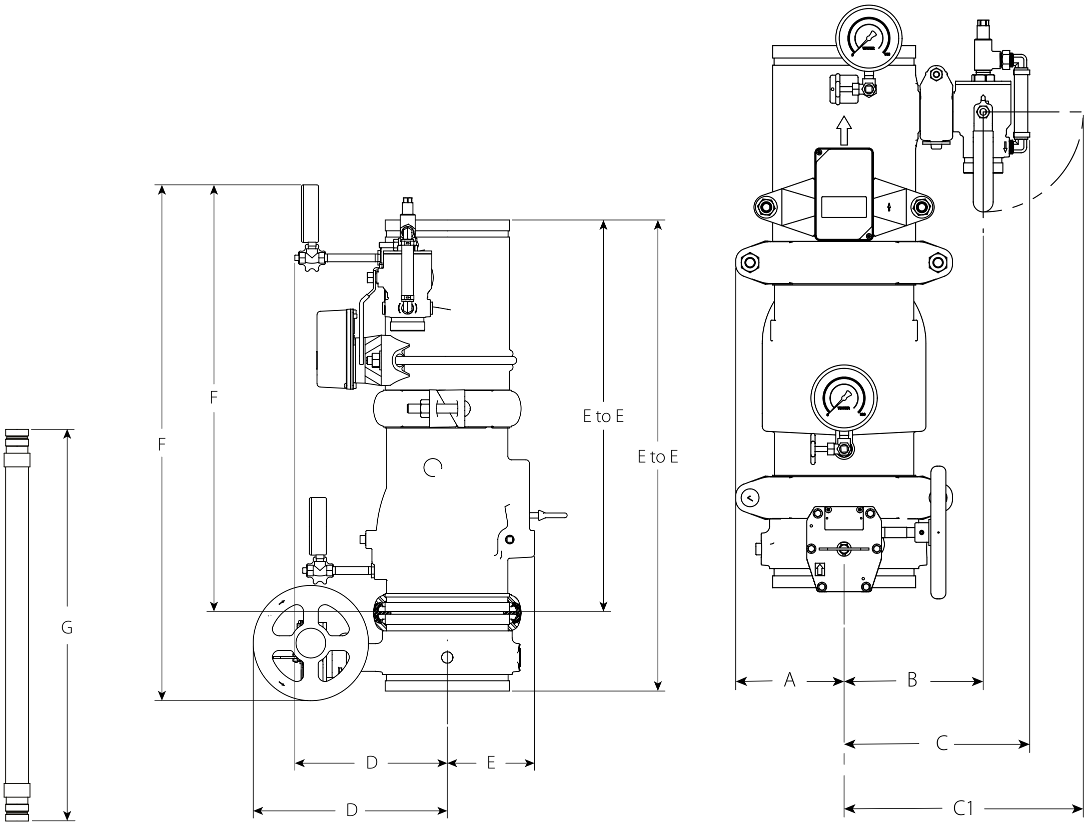


Horizontal Install Left Hand with Control Valve



Horizontal Install Right Hand with Control Valve

4.0 DIMENSIONS (CONTINUED)



Size		Dimensions														Weight	
Nominal	Actual Outside Dia.	E to E with control valve	E to E without control valve	A	B	C	C-1	D with control valve	D without control valve	E	F with control valve	F without control valve	Series UTD Valve Size (Nominal)	Series UTD Test Orifice	G Quick Drain Hose Length	Approx. (Each) with control valve	Approx. (Each) without control valve
inches DN	inches mm	inches mm											inches DN	K-Factor S.I.	inches mm	lb kg	lb kg
8 DN200	8.625 219.1	32.75 832	27.25 692	6.50 165	8.38 213	11.25 286	14.38 365	13.50 343	10.63 270	6.00 152	35.13 892	29.63 752	2.00 51	5.6 8.1	36.00 914	178.0 80.7	136.0 61.7

NOTE

- System supply pressure gauge port is on the supply side of check valve

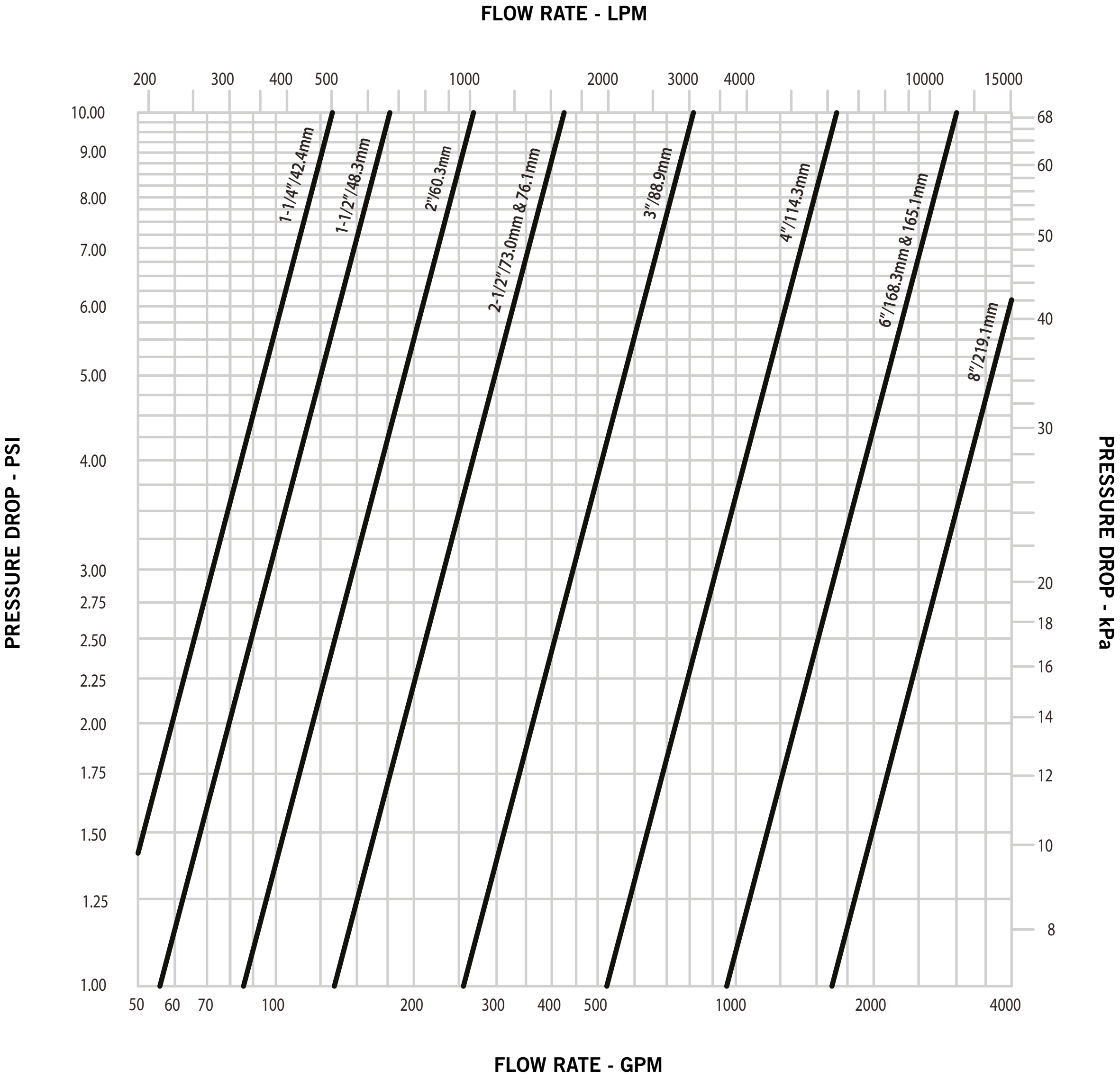
5.0 PERFORMANCE

Size		Equivalent Length of Sch. 40 Pipe[1]		Flow Characteristics		Maximum Working Pressure
Nominal inches DN	Actual Outside Diameter inches mm	with control valve feet meters	without control valve feet meters	Cv/Kv Values with control valve Full Open	Cv/Kv Values without control valve Full Open	psi kPa
1 ¼ DN32	1.660 42.4	8.3 2.5	8.0 2.4	38.52 33	35.59 31	300 2068
1 ½ DN40	1.900 48.3	10.1 3.1	10.0 3.0	56.75 49	57.43 50	300 2068
2 DN50	2.375 60.3	21.1 6.4	15.8 4.8	71.43 62	83.14 72	300 2068
2 ½	2.875 73.0	19.6 6.0	15.8 4.8	112.43 97	125.84 109	300 2068
DN65	3.000 76.1	19.6 6.0	15.8 4.8	112.43 97	125.84 109	300 2068
3 DN80	3.500 88.9	20.0 6.1	13.3 4.0	199.32 172	241.43 209	300 2068
4 DN100	4.500 114.3	17.6 5.4	12.9 3.9	425.88 368	499.23 432	300 2068
	6.500 165.1	40.6 12.4	32.0 9.8	834.97 722	932.83 807	300 2068
6 DN150	6.625 168.3	40.6 12.4	32.0 9.8	834.97 722	932.83 807	300 2068
8 DN200	8.625 219.1	60.8 18.5	45.8 13.9	1376.8 1191	1556.57 1346	300 2068

[1] Equivalent length of Sch 40 pipe calculated using the Hazen-Williams formula with a roughness coefficient of C=120

5.0 PERFORMANCE (CONTINUED)

Series UMC without Control Valve

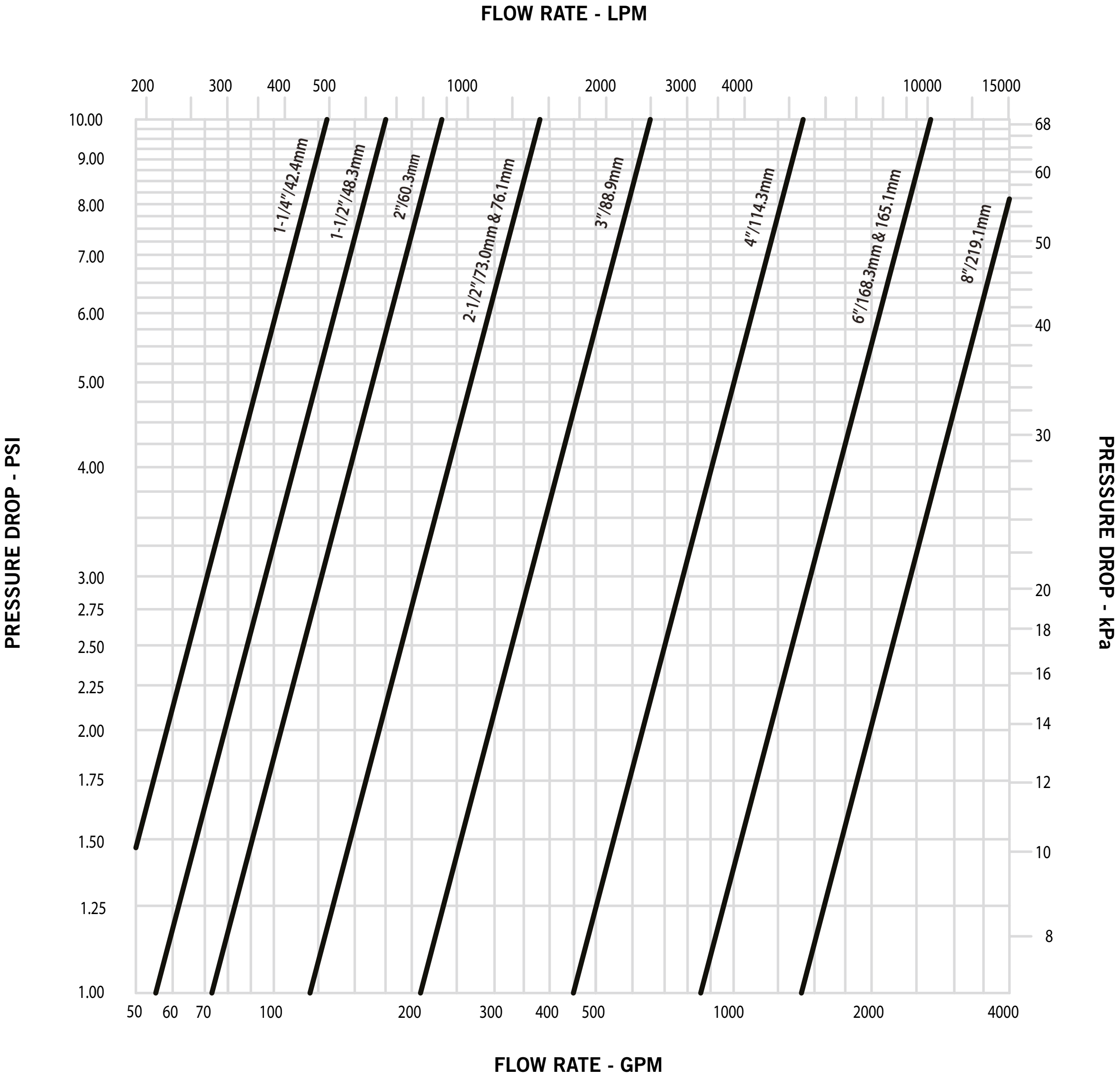


NOTE

- Includes friction loss across flow switch

5.0 PERFORMANCE (CONTINUED)

Series UMC with Control Valve



NOTE

- Includes friction loss across flow switch

6.0 NOTIFICATIONS

⚠ WARNING

- **Read and understand all instructions before attempting to install any Victaulic products.**
- **Always verify that the piping system has been completely depressurized and drained immediately prior to installation, removal, adjustment, or maintenance of any Victaulic products.**
- **Confirm that any equipment, branch lines, or sections of piping that may have been isolated for/during testing or due to valve closures/positioning are identified, depressurized, and drained intermediately prior to installation, removal, adjustment, or maintenance of any Victaulic products.**
- **Wear safety glasses, hardhat, and foot protection.**

Failure to follow these instructions could result in death or serious personal injury and property damage.

- **These products shall be used only in fire protection systems that are designed and installed in accordance with current, applicable National Fire Protection Association (NFPA 13, 13D, 13R, etc.) standards, or equivalent standards, and in accordance with applicable building and fire codes. These standards and codes contain important information regarding protection of systems from freezing temperatures, corrosion, mechanical damage, etc.**
- **The installer shall understand the use of this product and why it was specified for the particular application.**
- **The installer shall understand common industry safety standards and potential consequences of improper product installation.**

Failure to follow installation requirements and local and national codes and standards could compromise system integrity or cause system failure, resulting in death or serious personal injury and property damage.

7.0 REFERENCE MATERIALS

10.17: FireLock® Ball Valve

10.54: Victaulic FireLock™ Innovative Groove System I IGS™

10.64: Victaulic® FireLock™ Installation-Ready™ Rigid Couplings

10.81: FireLock® Butterfly Valve

30.71: Series UM Universal Manifold Assembly

30.73: Victaulic® Series UTD Universal Test and Drain

30.74: Victaulic® Series ARV Adjustable Relief Valve

I-100: Field Installation Handbook

I-UMC: Series UMC Universal Manifold Check Assembly

Victaulic® Series UTD Universal Test and Drain

1.0 PRODUCT DESCRIPTION

Available Sizes

- 1 – 2"/DN25 – DN50

Pressure Class

- Up to 300 psi/2068 kPa/21 Bar

Test Orifice K-Factor

- 1"/DN25 - K2.8 (4.0)
- 1 ¼"/DN32 – K4.2 (6.0)
- 2"/DN50 – K5.6 (8.1)

Available Connections

- 1"/DN25 – NPT/IGS
- 1 ¼"/DN32 – NPT/OGS
- 2"/DN50 – NPT/OGS

Ports

- (2) Integrated ports with clear Polycarbonate plugs, allowing for a visual indication water is flowing

Standard

- Preinstalled Series ARV (refer to publication 30.74) and plastic tubing.

2.0 CERTIFICATION/LISTINGS

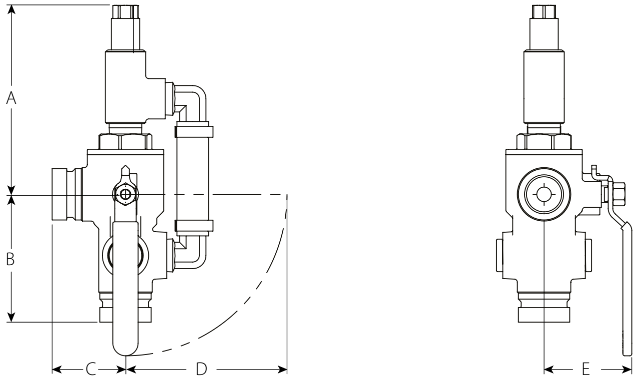
c UL us LISTED FM APPROVED

3.0 SPECIFICATIONS – MATERIAL

3 Way Test and Drain Body: Brass
UTD Test and Drain Ball: Chrome-plated brass
UTD Test and Drain Handle Stem: Stainless Steel
3-Way Test and Drain Stem O-Ring: EPDM
UTD Test and Drain Seal: PTFE
Sight Glass: Polycarbonate
3-Way Red Handle: EPDM
Retaining Nut: Stainless Steel

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

4.0 DIMENSIONS



Size		Dimensions					Weight
Nominal inches DN	**Actual Outside Diameter** inches mm	**A** inches mm	**B** inches mm	**C** inches mm	**D** inches mm	**E** inches mm	**Approximate (Each)** lb kg
1 DN25	1.315 33.7	4.88 124	3.25 83	1.88 48	4.13 105	2.13 54	3.3 1.5
1 ¼ DN32	1.660 42.4	5.00 127	3.38 86	2.25 57	4.88 124	2.63 67	4.6 2.1
2 DN50	2.375 60.3	5.50 140	3.75 95	2.75 70	6.00 152	3.38 86	8.2 3.7

5.0 PERFORMANCE

Size		Maximum Working Pressure psi kPa
Nominal inches DN	Actual Outside Diameter inches mm	
1 DN25	1.315 33.7	300 2068
1 ¼ DN32	1.660 42.4	300 2068
2 DN50	2.375 60.3	300 2068

6.0 NOTIFICATIONS

⚠ WARNING

- **Read and understand all instructions before attempting to install, remove, adjust, or maintain any Victaulic piping products.**
- **Depressurize and drain the piping system before attempting to install, remove, adjust, or maintain any Victaulic piping products.**
- **Wear safety glasses, hardhat, and foot protection.**

Failure to follow these instructions could result in death or serious personal injury and property damage.

7.0 REFERENCE MATERIALS

30.71: Series UM Universal Manifold Assembly
30.72: Series UMC Universal Manifold Control Assembly
10.54: FireLock™ Innovative Groove System I IGS™
10.64: FireLock™ Installation-Ready™ Rigid Couplings Style 009N and Style 109
30.74: Series ARV Adjustable Relief Valve

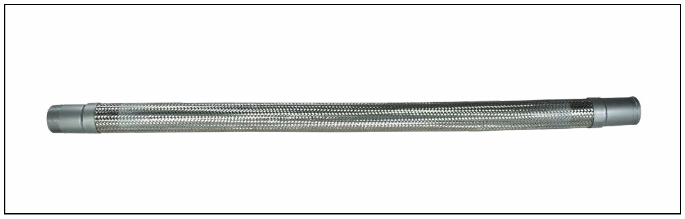
Streamline™ Drain Hoses

Product Description

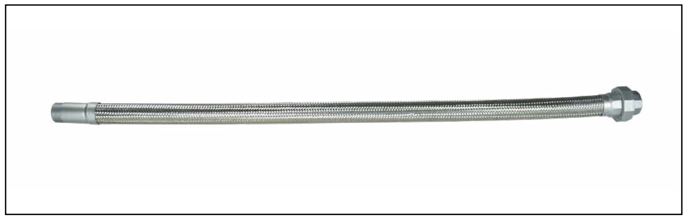
Reliable Streamline™ Drain Hoses are intended for making fire protection system drain connections, and are available in the following nominal sizes and end configurations:

- 1" x 24" MNPT x FNPT Union
- 1-1/4" x 24" MNPT x FNPT Union
- 1-1/4" x 36" MNPT x FNPT Union
- 1-1/4" x 48" MNPT x FNPT Union
- 2" x 48" MNPT x AWWA C606 Groove

The hoses are intended for use in fire protection system drains only, and are not for use in supply piping or pressurized parts of systems.



2" x 48" MNPT x Groove



1-1/4" x 48" MNPT x FNPT Union

Note: Not all versions of the product are shown.

Installation

Connect one end of the Reliable Streamline™ Drain Hose to the system main drain valve, and the opposite end of the drain piping or manifold and tighten. Avoid kinking the hose. Installation practices should be in accordance with the requirements of NFPA 13 and other applicable standards.

Maintenance

The owner is responsible for maintaining the fire protection system in proper operating condition. The Reliable Streamline™ Drain Hose shall periodically be given a thorough inspection. NFPA 25, "Inspection, Testing and Maintenance of Water Based Fire Protection Systems," provides minimum inspection and maintenance requirements.

Materials **Table A**

Component	Material
Union (1-1/4")	Carbon Steel FCMB
Gasket (1-1/4")	Teflon
Corrugated Tube	STS304
Braid	STS304
Sleeve	STS304
Threaded or Grooved End Connection	Carbon Steel SPP

Guarantee

For Reliable Automatic Sprinkler Co., Inc. guarantee, terms, and conditions, visit www.reliablesprinkler.com.

Ordering Information

Specify:

Reliable Streamline™ Drain Hose
- 1" x 24" MNPT x FNPT Union
- 1-1/4" x 24" MNPT x FNPT Union
- 1-1/4" x 36" MNPT x FNPT Union
- 1-1/4" x 48" MNPT x FNPT Union
- 2" x 48" MNPT x AWWA C606 Groove

P/N 9999970582

Worldwide Contacts | www.tyco-fire.com

Model DPV-1 Dry Pipe Valve External Resetting

IMPORTANT
Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp1020

Available Sizes and End Connections				
End Connection	Nominal Valve Size			
	2-1/2 in. (DN65)	3 in. (DN80)	4 in. (DN100)	6 in. (DN150)
Flange x Flange	N/A	N/A	•	•
Flange x Groove	N/A	N/A	•	•
Groove x Groove	•	•	•	•

• = Available
N/A = Not Available

General Description

The TYCO Model DPV-1 Dry Pipe Valves are differential valves used to automatically control the flow of water into dry pipe fire protection sprinkler systems upon operation of one or more automatic sprinklers. The DPV-1 also provides for actuation of fire alarms upon system operation. The Model DPV-1 features are as follows:

- External reset.
- 250 psi (17,2 bar) pressure rating.
- Unique offset single clapper design enabling a simple compact valve to minimize installation labor.
- Ductile iron construction to ensure a lightweight valve to minimize shipping cost.
- A variety of inlet and outlet connections.
- Compact, Pre-Trimmed, and Semi-Assembled, easy to operate valve trim.
- Simple reset procedure through the elimination of priming water.

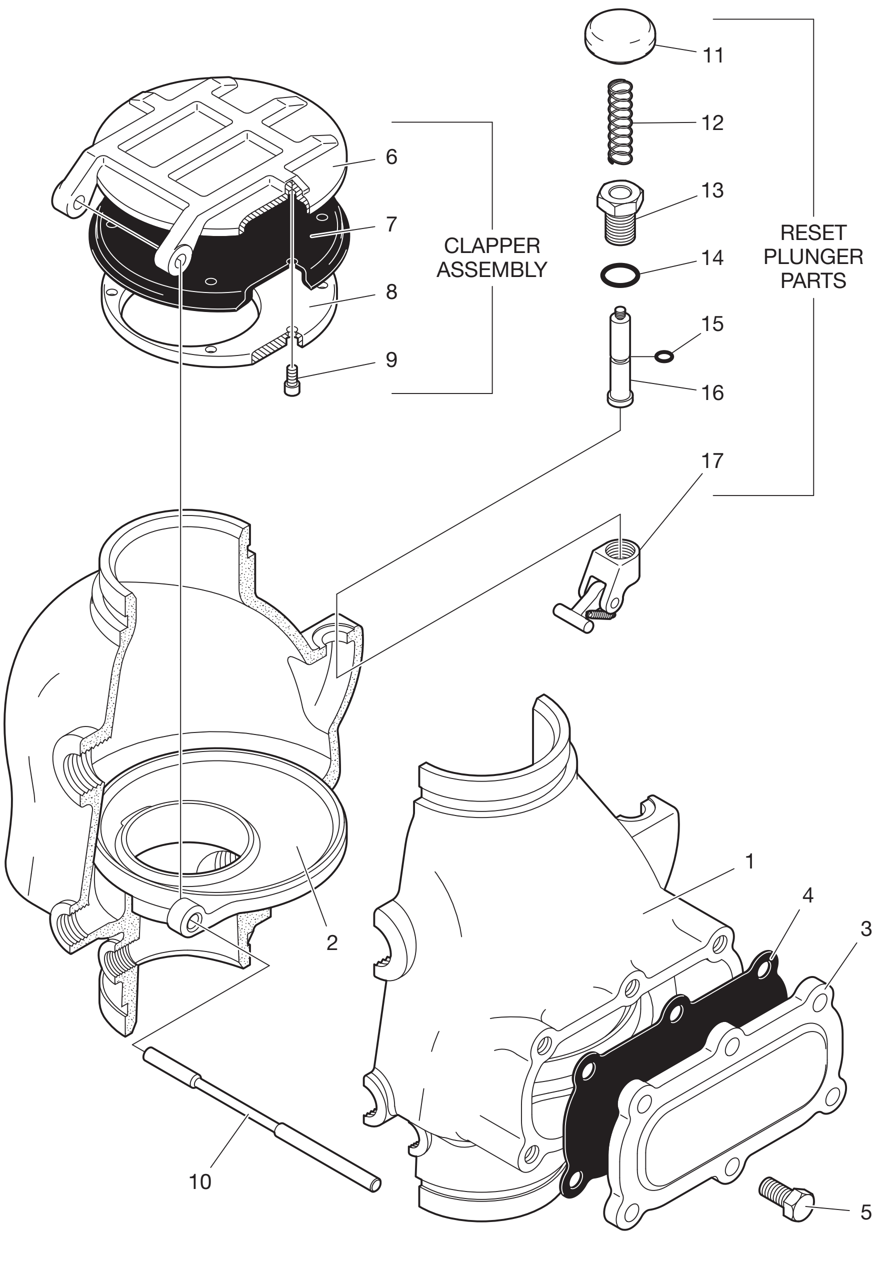
Dry pipe sprinkler systems are used in unheated warehouses, parking garages, store windows, attic spaces, loading docks, and other areas exposed to freezing temperatures, where water filled pipe cannot be utilized. When set for service, the dry pipe sprinkler system is pressurized with air (or nitrogen). The loss of pressure through an operated automatic sprinkler in response to heat from a fire permits the DPV-1 Dry Pipe Valve to open and allow a flow of water into the sprinkler system piping. Table B establishes the minimum required system air pressure that includes a safety factor to help prevent false operations that might occur due to water supply fluctuations.

NOTICE

The Model DPV-1 Dry Pipe Valves described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION (NFPA), in addition to the standards of any authorities having jurisdiction, such as FM Global. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

In all cases, the appropriate NFPA or FM Global installation standard, or other applicable standard, must be referenced to ensure applicability and to obtain complete installation guidelines. The general guidelines in this data sheet are not intended to provide complete installation criteria.



NO.	DESCRIPTION	QTY.	REF.
1	Valve Body	1	NR[1]
2	Air and Water Seat	1	NR[1]
3	Handhole Cover . . .	1	NR[1]
4	Handhole Cover Gasket	1	(b)
5	1/2-13 UNC x 1" Hex Head Cap Screw:		
	2-1/2, 3 Inch Valves	5	CH[2]
	4 Inch Valve	6	CH[2]
6	Clapper	1	(a)
7	Clapper Facing	1	(a) or (b)
8	Clapper Facing Retaining Plate	1	(a)
9	2-1/2, 3 Inch Valves: 1/4" x 3/8" Long #10-32 Shoulder Screw	5	(a)
	4 Inch Valve: 1/4-20 UNC x 1/2" Socket Head Cap Screw	7	(a)
10	Clapper Hinge Pin	1	(a)
11	Reset Knob	1	(c) or (d)
12	Reset Spring	1	(c)
13	Reset Bushing	1	(c)
14	Reset Bushing O-Ring.	1	(b), (c) or (e)
15	Reset Plunger O-Ring[3]	1	(b) or (c)
16	Reset Plunger	1	(c)
17	Reset Latch Subassembly	1	(c)

NOTES:
1. NR = Not Replaceable
2. CH = Common Hardware
3. Dow Corning FS3452 Flourosilicone Grease factory-applied to Reset Plunger O-Ring; Do not remove grease when reassembling valve.

REPLACEMENT PARTS

NO.	DESCRIPTION	P/N
(a)	Clapper Assembly Includes Items 6-10:	
	2-1/2, 3 Inch Valves . . .	92-312-2-203
	4 Inch Valve	92-312-2-403
(b)	Repair Parts Kit Includes Items 4, 7, 14, 15	
	2-1/2, 3 Inch Valves . . .	92-312-1-204
	4 Inch Valve	92-312-1-404
(c)	Reset Plunger Parts Kit Includes Items 11-17 . .	92-312-1-405
(d)	Reset Knob, Item 11. . .	92-312-1-406
(e)	Reset Plunger O-Ring, Item 15	92-312-1-407

FIGURE 1 - PART 1 OF 2
MODEL DPV-1 DRY PIPE VALVE
2-1/2, 3, AND 4 INCH (DN65, DN80, DN100) ASSEMBLIES

NO.	DESCRIPTION	QTY.	REF.
1	Valve Body	1	NR[1]
2	Air and Water Seat	1	NR[1]
3	Water Seal O-Ring	1	NR[1]
4	Air Seal O-Ring	1	NR[1]
5	3/8-16 UNC x 1" Socket Head Cap Screw	8	NR[1]
6	Handhole Cover	1	NR[1]
7	Handhole Cover Gasket	1	(b)
8	5/8-11 UNC x 1" Hex Head Cap Screw	6	CH[2]
9	Clapper	1	(a)
10	Clapper Facing	1	(a) or (b)
11	Clapper Facing Retaining Plate	1	(a)
12	1/4-20 UNC x 1/2" Socket Head Cap Screw	9	(a)
13	Clapper Hinge Pin	1	(a)
14	Reset Knob	1	(c) or (d)
15	Reset Spring	1	(c)
16	Reset Bushing	1	(c)
17	Reset Bushing O-Ring	1	(b), (c) or (e)
18	Reset Plunger O-Ring[3]	1	(b) or (c)
19	Reset Plunger	1	(c)
20	Reset Latch Subassembly	1	(c)

NOTES:
1. NR = Not Replaceable
2. CH = Common Hardware
3. Dow Corning FS3452 Flourosilicone Grease factory-applied to Reset Plunger O-Ring; Do not remove grease when reassembling valve.

REPLACEMENT PARTS		
NO.	DESCRIPTION	P/N
(a)	Clapper Assembly Includes Items 9-13	92-312-2-603
(b)	Repair Parts Kit Includes Items 7, 10, 17, 18	92-312-1-604
(c)	Reset Plunger Parts Kit Includes Items 14-20	92-312-1-405
(d)	Reset Knob, Item 14	92-312-1-406
(e)	Reset Plunger O-Ring, Item 18	92-312-1-407

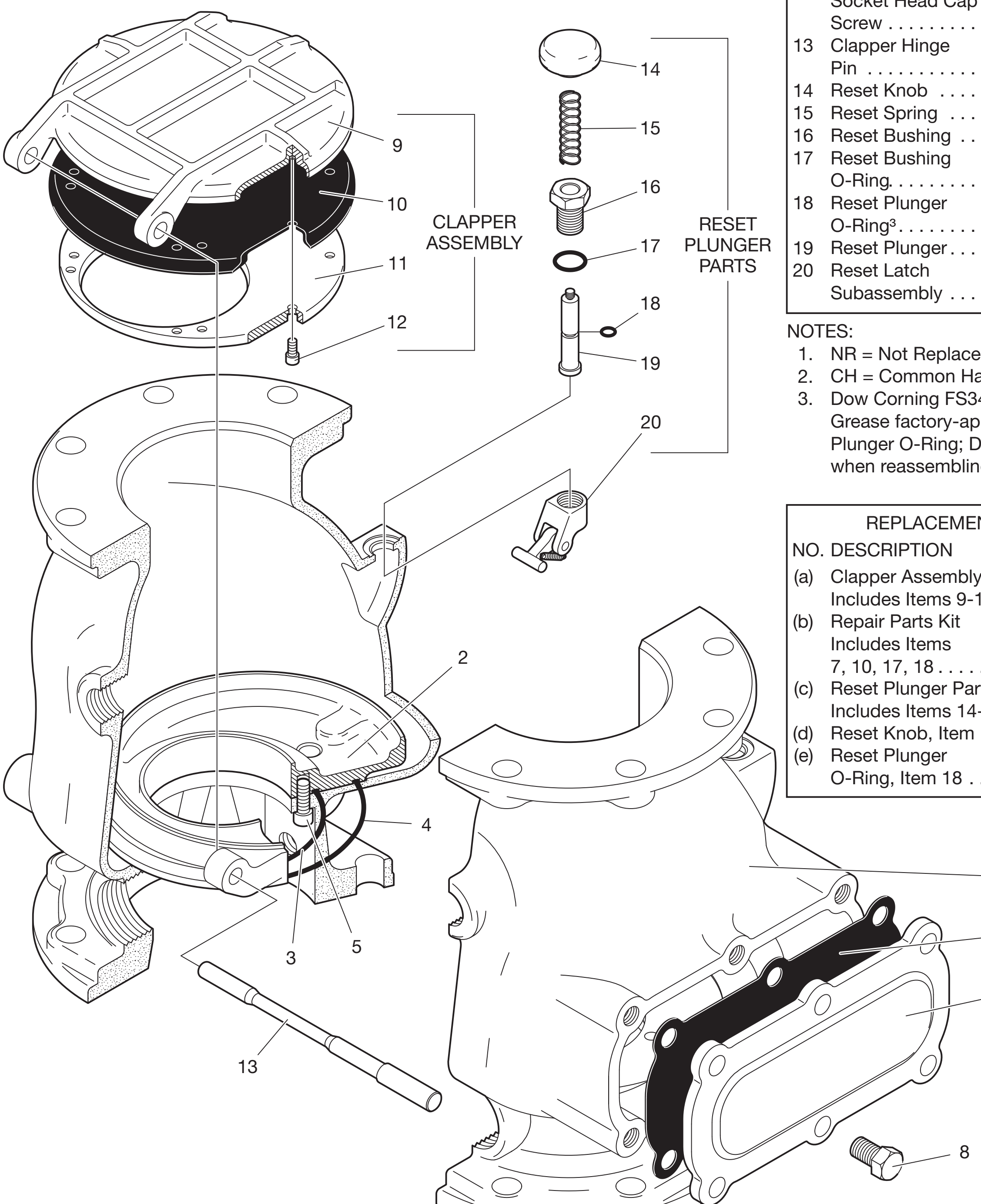


FIGURE 1 - PART 2 OF 2
MODEL DPV-1 DRY PIPE VALVE
6 INCH (DN150) ASSEMBLY

Technical Data

Approvals
UL and C-UL Listed
FM Approved

Dry Pipe Valve
The TYCO Model DPV-1 Dry Pipe Valves shall be installed in the vertical orientation only (supply at bottom flowing upward) and are rated for use at a maximum service pressure of 250 psi (17,2 bar). Valve and trim dimensions are shown in Figure 6.

Flanged connections are available and drilled per ANSI, ISO, AS, and JIS specifications as shown in Table A. The grooved outlet connections, as applicable, are cut in accordance with standard groove specifications for steel pipe. They are suitable for use with grooved end pipe couplings that are listed or approved for fire protection system service. Available combinations of inlet and outlet connections are described in the Ordering Procedure section and in the Available End Connection and Sizes table on page 1.

Trim port connections of valves having flanges drilled to ANSI, AS, or JIS specifications are NPT threaded per ANSI Standard B1.20.1. Trim port connections of valves having flanges drilled to ISO are available either threaded per ISO 7-1 or NPT threaded per ANSI Standard B1.20.1. Valves with NPT threaded ports will readily accept the trim arrangements shown in Parts 2 and 3 of Figures 3, 4, and 5.

Model DPV-1 Valve assemblies are shown in Figure 1. The body and handhole cover are ductile iron. The handhole cover gasket is neoprene, and the clapper facing is EPDM. The air/water seat ring is brass, the clapper is bronze or aluminum bronze, and both the clapper retaining plate and latch are bronze. The hinge pin is aluminum bronze, and the fasteners for the handhole cover are carbon steel.

Valve Trim
Installation dimensions are provided in Figure 6, and valve trim and pre-trimmed valve assemblies are shown in Figures 3, 4, and 5.

The valve trim, ordered separately or as a pre-trimmed valve assembly, forms a part of the laboratory listings and approvals of the DPV-1 valve and is necessary for the proper operation of the DPV-1 valve.

Trim packages or pre-trimmed valve assemblies include the following equipment:

- Water Supply Pressure Gauge
- System Air Pressure Gauge
- Air Supply Connections
- Main Drain Valve
- Low Body Drain Valve
- Alarm Test Valve
- Automatic Drain Valve
- Drip Funnel
- Connections For Optional Quick Opening Device (Accelerator)

Pre-trimmed valve assemblies also include the following equipment:

- Model BFV-300 Butterfly Valve
- Figure 577 Grooved Coupling
- PS10-2 Waterflow Alarm Switch
- PS40-2 Low Air Pressure Alarm Switch

Order the above equipment separately when ordering trim packages separately.

Note: *When the system pressure is greater than 175 psi (12,1 bar), provision shall be made to replace the standard order 300 psi (20,7 bar) water pressure gauge with a separately ordered 600 psi (41,4 bar) water pressure gauge.*

Weights
The following are the nominal weights for pre-trimmed valve assemblies, semi-assembled trim, and DPV-1 valves without trim.

Pre-Trimmed DPV-1 Valve Assemblies:

2-1/2 in. (DN65) G x G	87 lb (40 kg)
3 in. (DN80) G x G	90 lb (42 kg)
4 in. (DN100) G x G	121 lb (56 kg)
4 in. (DN100) F x G	135 lb (64 kg)
4 in. (DN100) F x F	145 lb (69 kg)
6 in. (DN150) G x G	175 lb (81 kg)
6 in. (DN150) F x G	195 lb (90 kg)
6 in. (DN150) F x F	208 lb (96 kg)

Standard Galvanized Semi-Assembled DPV-1 Trim:

2-1/2 in. (DN65)	23 lb (11 kg)
3 in. (DN80)	23 lb (11 kg)
4 in. (DN100)	30 lb (14 kg)
6 in. (DN150)	30 lb (14 kg)

DPV-1 Valve (Without Trim):

2-1/2 in. (DN65) G x G	37 lb (17 kg)
3 in. (DN80) G x G	38 lb(18 kg)
4 in. (DN100) G x G	57 lb (26 kg)
4 in. (DN100) F x G	67 lb (31 kg)
4 in. (DN100) F x F	77 lb (36 kg)
6 in. (DN150) G x G	95 lb (44 kg)
6 in. (DN150) F x G	108 lb (50 kg)
6 in.(DN150) F x F	121 lb (56 kg)

Air Supply
Table B shows the system air pressure requirements as a function of the water supply pressure. The air (or nitrogen) pressure in the sprinkler system is recommended to be automatically maintained by using one of the following pressure maintenance devices, as appropriate:

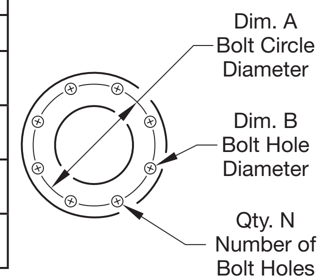
- Model AMD-1 Air Maintenance Device (pressure reducing type)
- Model AMD-2 Air Maintenance Device (compressor control type)
- Model AMD-3 Nitrogen Maintenance Device (high pressure reducing type)

The pressure relief valve provided with the valve trim is factory set to relieve at a pressure of approximately 45 psi (3,1 bar). If the normal system air pressure is less than or exceeds 40 psi (2,8 bar), then the pressure relief valve must be reset to relieve at a pressure that is in accordance with the authority having jurisdiction.

Quick Opening Device
The Model DPV-1 Dry Pipe Valve may optionally be equipped with an electronic or mechanical dry pipe valve accelerator. Select the VIZOR Electronic Dry Pipe Valve Accelerator (4 and 6 in. sizes only) as described in Technical Data Sheet TFP1105, or the Model ACC-1 Mechanical Dry Pipe Valve Accelerator (2-1/2 through 6 in. sizes) as described in Technical Data Sheet TFP1112.

The VIZOR or the ACC-1 is used to reduce the time to valve actuation following the operation of one or more automatic sprinklers. In some cases the use of a quick opening device such as the VIZOR or the ACC-1 may be required to meet the requirements of the NFPA to meet water delivery times.

Nominal Valve Size	Flange Drilling Specification											
	Nominal Dimensions in Inches and (mm)											
	ANSI B16.42[1] (Class 150)			ISO 7005-2 (PN16)[2]			JIS B 2210 (10K)			AS 2129 (Table E)		
	Dim. A	Dim. B	Qty. N	Dim. A	Dim. B	Qty. N	Dim. A	Dim. B	Qty. N	Dim. A	Dim. B	Qty. N
4 in. (DN100)	7.50 (190,5)	0.75 (19,0)	8	7.09 (180,0)	0.75 (19,0)	8	6.89 (175,0)	0.59 (15,0)	8	7.00 (178,0)	0.71 (18,0)	8
6 in. (DN150)	9.50 (241,3)	0.88 (22,2)	8	9.45 (240,0)	0.91 (23,0)	8	9.45 (240,0)	0.75 (19,0)	8	9.25 (235,0)	0.87 (22,0)	8

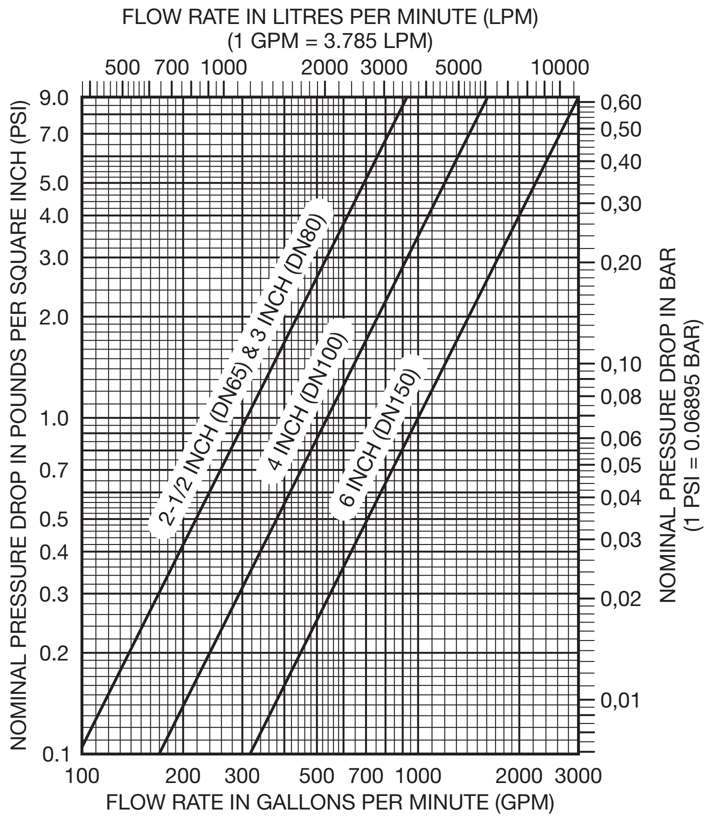


1. Drilling same as ANSI B16.1 (Class 125).
2. Drilling same as BS 4504 Section 3.2 (PN16) and DIN 2532 (PN16).

TABLE A
SELECTION OF FLANGE DRILLING SPECIFICATIONS

Maximum Water Supply Pressure psi	System Air Pressure Range psi
20	10
60	15 - 23
80	20 - 28
100	25 - 33
120	30 - 38
145	35 - 43
165	40 - 48
185	45 - 53
205	50 - 58
225	55 - 63
250	60 - 68

TABLE B
SYSTEM AIR PRESSURE REQUIREMENTS



The approximate friction losses, based on the Hazen and Williams formula and expressed in equivalent length of Schedule 40 pipe with C=100 and flowing at typical flow rates, are as follows:

2-1/2 in. valve at 250 GPM flow = 2.2 ft
3 in. valve at 350 GPM flow = 4.9 ft
4 in. valve at 600 GPM flow = 8.9 ft
6 in. valve at 1500 GPM flow = 22.0 ft

GRAPH A
MODEL DPV-1 DRY PIPE VALVES
NOMINAL PRESSURE LOSS VS. FLOW

Operation

The TYCO Model DPV-1 Dry Pipe Valve is a differential type valve that utilizes a substantially lower system (air or nitrogen) pressure than the supply (water) pressure, to maintain the set position shown in Figure 2A. The differential nature of the DPV-1 is based on the area difference between the air seat and the water seat in combination with the ratio of the radial difference from the hinge pin to the center of the water seat and the hinge pin to the center of the air seat. The difference is such that 1 psi (0,07 bar) of system air pressure can hold approximately 5.5 psi (0,38 bar) of water supply pressure.

Table B establishes the minimum required system air pressure that includes a safety factor to help prevent false operations that occur due to water supply fluctuations.

The intermediate chamber of the DPV-1 is formed by the area between the air seat and water seat as shown in Figure 2B. The intermediate chamber normally remains at atmospheric pressure through the alarm port connection and the valve trim to the normally open automatic drain valve, see Fig. 3, 4, or 5. Having the intermediate chamber, as shown in Figure 2B, open to atmosphere is critical to the DPV-1 valve remaining set, otherwise the full resulting pressure of the system air pressure on top of the clapper assembly cannot be realized.

For example, and assuming a water supply pressure of 100 psi (6,9 bar), if the system air pressure is 25 psi (1,7 bar) and there was 15 psi (1,0 bar) pressure trapped in the intermediate chamber, the resulting pressure across the top of the clapper would only be 10 psi (0,7 bar). This pressure would be insufficient to hold the clapper assembly closed against a water supply pressure of 100 psi (6,9 bar). It is for this reason that the plunger of the automatic drain valve must be depressed during several of the resetting steps, as well as during inspections, making certain that the automatic drain valve is open.

When one or more automatic sprinklers operate in response to a fire, air pressure within the system piping is relieved through the open sprinklers. When the air pressure is sufficiently reduced, the water pressure overcomes the differential holding the clapper assembly closed and the clapper assembly swings clear of the water seat, as shown in Figure 2C, This action permits water flow into the system piping and subsequently to be discharged from any open sprinklers. Also, with the clapper assembly open, the intermediate chamber is pressurized and water flows through the alarm port as shown in Figure 2B at the rear of the DPV-1 valve to actuate system water flow alarms. The flow from the alarm port is also sufficient to close the otherwise normally open automatic drain valve in the valve trim.

After a valve actuation and upon subsequent closing of a system main control valve to stop water flow, the clapper assembly will latch open as shown in Figure 3D. Latching open of the DPV-1 will permit complete draining of the system (including any loose scale) through the main drain port.

During the valve resetting procedure and after the system is completely drained, the external reset knob can be easily depressed to externally unlatch the clapper assembly as shown in Figure 2E. As such, the clapper assembly is returned to its normal set position to facilitate setting of the dry pipe sprinkler system, without having to remove the handhole cover.

Installation

General Instructions
Proper operation of the Model DPV-1 Dry Pipe Valve depends upon its trim being installed in accordance with the instructions given in this Technical Data Sheet. Failure to follow the appropriate trim diagram may prevent the DPV-1 valve from functioning properly, as well as void listings, approvals, and the manufacturer warranties.

Failure to latch open the clapper assembly prior to a system hydrostatic test may result in damage to the clapper assembly.

The DPV-1 valve must be installed in a readily visible and accessible location.

The DPV-1 valve and associated trim must be maintained at a minimum temperature of 40°F (4°C).

Heat tracing of the DPV-1 valve or its associated trim is not permitted. Heat tracing can result in the formation of hardened mineral deposits that are capable of preventing proper operation.

The Model DPV-1 Dry Pipe Valve is to be installed in accordance with the following criteria:

- All nipples, fittings, and devices must be clean and free of scale and burrs before installation. Use pipe thread sealant sparingly on male pipe threads only.
- The DPV-1 valve must be trimmed in accordance with Figures 3, 4, or 5, as applicable. If the DPV-1 is to be equipped with a dry pipe valve accelerator, refer to the Technical Data Sheet TFP1105 for the VIZOR Electronic Dry Pipe Valve Accelerator or TFP1112 for the Model ACC-1 Mechanical Dry Pipe Valve Accelerator.
- Care must be taken to make sure that components such check valves, strainers, and globe valves are installed with the flow arrows in the proper direction.
- Drain tubing to the drip funnel must be installed with smooth bends that will not restrict flow.
- The main drain and drip funnel drain may be interconnected provided a check valve is located at least 12 in. (300 mm) below the drip funnel. The low body drain valve, as shown in Fig. 3, 4, or 5, may be piped so as to discharge into the Drip Funnel or to a separate drain.
- Suitable provision must be made for disposal of drain water. Drainage water must be directed such that it will not cause accidental damage to property or danger to persons.
- Unused pressure alarm switch and/or water motor alarm connections must be plugged.
- The pressure relief valve provided with the valve trim is factory set to relieve at a pressure of approximately 45 psi (3,1 bar), which can typically be used for a maximum normal system air pressure of 40 psi (2,8 bar). The pressure relief valve may be reset to a lower or higher pressure; however, it must be reset to relieve at a pressure which is in accordance with the requirements of the authority having jurisdiction.

  To reset the pressure relief valve, first loosen the jam nut and then adjust the cap accordingly — clockwise for a higher pressure setting or counter-clockwise for a lower pressure setting. After verifying the desired pressure setting, tighten the jam nut.
- It is best practice to install an appropriately rated and listed relief valve upstream of the Model DPV-1 Dry Pipe Valve, between the inlet of the DPV-1 valve and any check valves or back flow preventers, to ensure transient increases in water pressure do not cause unintended operation of the DPV-1 valve.
- Installation of an air maintenance device, as described in the Technical Data Section, is recommended.
- An inspector's test connection as required By NFPA 13 must be provided on the system piping at the most remote location from the Model DPV-1 Valve.
- Conduit and electrical connections are to be made in accordance with the requirements of the authority having jurisdiction and/or the National Electric Code.
- Before a system hydrostatic test is performed in accordance with NFPA 13 system acceptance test requirements, the clapper assembly is to be manually latched open as shown in Figure 2D; the automatic drain valve as shown in Figures 3, 4, or 5 is to be temporarily replaced with a 1/2 in. NPT plug, the 3/32 in. vent fitting (Item 13, Figure 3; Item 15, Figure 4; or Item 15, Figure 5) is to be temporarily replaced with a 1/4 in. NPT plug, and the handhole cover bolts are to be tightened using a cross-draw sequence.

Valve Setting Procedure

Steps 1 through 11 are to be performed when initially setting the Model DPV-1 Dry Pipe Valve; after an operational test of the fire protection system; or, after system operation due to a fire.

NOTES: *If the DPV-1 is equipped with a dry pipe valve accelerator, refer to its resetting instructions before resetting the DPV-1. Refer to TFP1105 for the VIZOR or TFP1112 for the ACC-1.*

Based on the instructions provided, reset the Accelerator at the appropriate time during the resetting of the DPV-1.

Unless otherwise noted, see Figure 3, 4, or 5 to identify functional trim components.

Step 1. Close the main control valve, and close the air supply control valve. If the DPV-1 is equipped with a dry pipe valve accelerator, remove the dry pipe valve accelerator from service in accordance with the Technical Data Sheet (TDS) instructions, refer to TDS TFP1105 for the VIZOR or TDS TFP1112 for the ACC-1.

Step 2. Open the main drain valve and all auxiliary drains in the system. Close the auxiliary drain valves after water ceases to discharge. Leave the main drain valve open.

Step 3. Depress the plunger of the automatic drain valve to verify that it is open and that the DPV-1 valve is completely drained.

Step 4. Open the optional alarm control valve, as applicable, if it was closed to silence local alarms.

Step 5. As necessary, replace all sprinklers that have operated. Replacement sprinklers must be of the same type and temperature rating as those which have operated.

NOTICE

In order to prevent the possibility of a subsequent operation of an overheated solder type sprinkler, any solder type sprinklers which were possibly exposed to a temperature greater than their maximum rated ambient must be replaced.

Step 6. Push down on the reset knob as shown in Figure 2E to allow the clapper assembly to re-seat.

Step 7. Pressurize the system with air (or nitrogen) to 10 psi (0,7 bar), and then individually open all auxiliary drain valves in the system piping to drain any remaining water in trapped sections. Close each drain valve as soon as water ceases to discharge.

Also partially open the low body drain valve to assure that the riser is completely drained. Close the low body drain valve as soon as water ceases to discharge.

Step 8. Refer to Table B and then restore the system to the normal system air pressure as necessary to hold the DPV-1 valve closed.

Step 9. Depress the plunger on the automatic drain valve to make sure it is open and that there is no air discharging.

The absence of air discharging from the automatic drain valve is an indication of a properly set air seat within the DPV-1 valve. If air is discharging, refer to the Care and Maintenance section under Automatic Drain Valve Inspection to determine/correct the cause of the leakage problem.

Step 10. Partially open the main control valve. Slowly close the main drain valve as soon as water discharges from the drain connection.

Depress the plunger on the automatic drain valve to make sure that it is open and that there is no water discharging. The absence of water discharging from the automatic drain valve is an indication of a properly set water seat within the DPV-1 valve. If water is discharging, refer to the Care and Maintenance section under the Automatic Drain Valve Inspection to determine/correct the cause of the leakage problem.

If there are no leaks, the DPV-1 valve is ready to be placed in service and the main control valve must then be fully opened.

Note: *After setting a fire protection system, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.*

Step 11. Once a week after a valve is reset following an operational test or system operation, the low body drain valve (and any low point drain valves) should be partially opened (and then subsequently closed) to relieve drain-back water. Continue this procedure until drain-back water is no longer present.

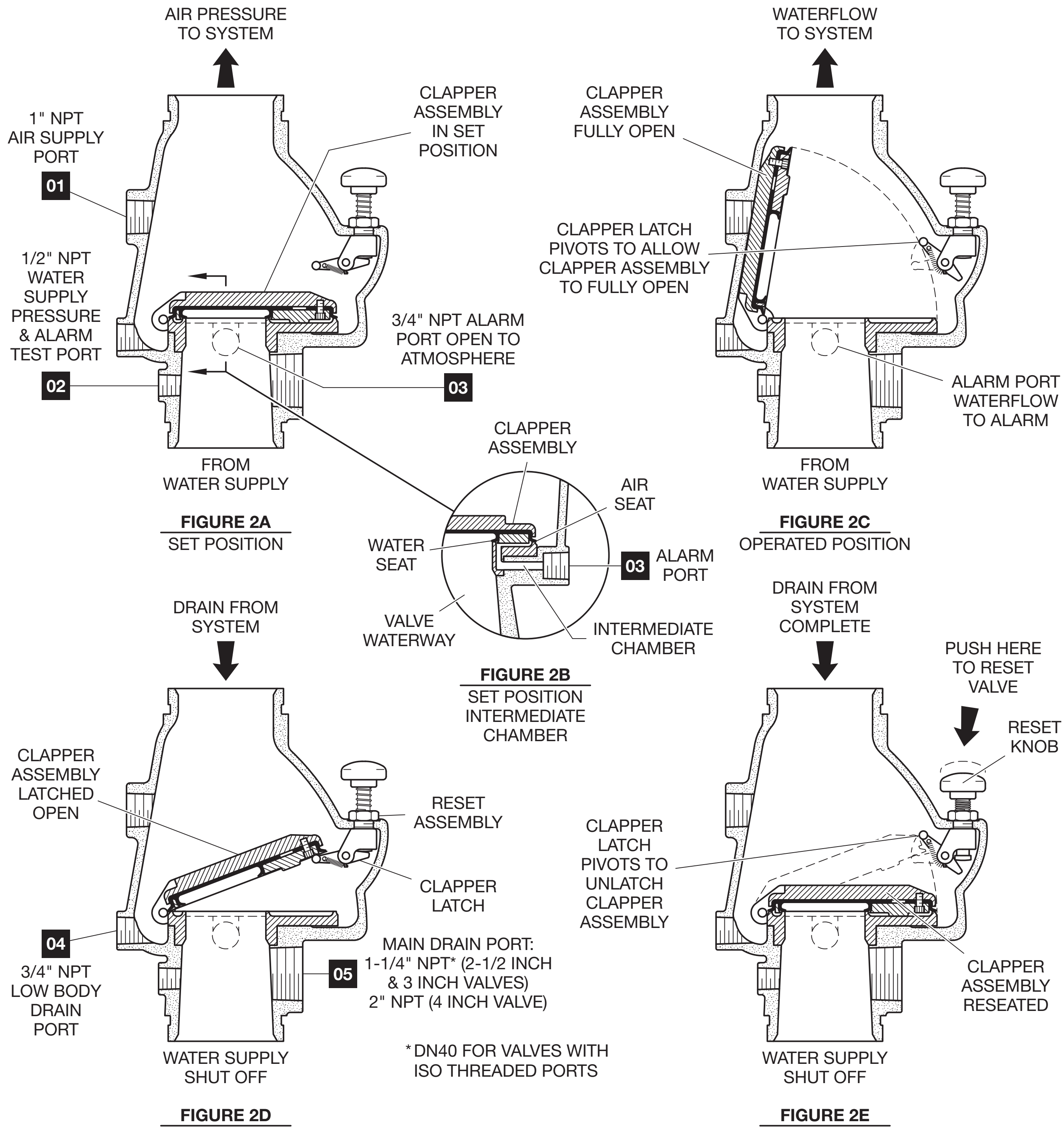


FIGURE 2 - PART 1 OF 2
MODEL DPV-1 DRY PIPE VALVES
2-1/2, 3, AND 4 INCH (DN65, DN80, AND DN100)
SET AND OPEN POSITIONS

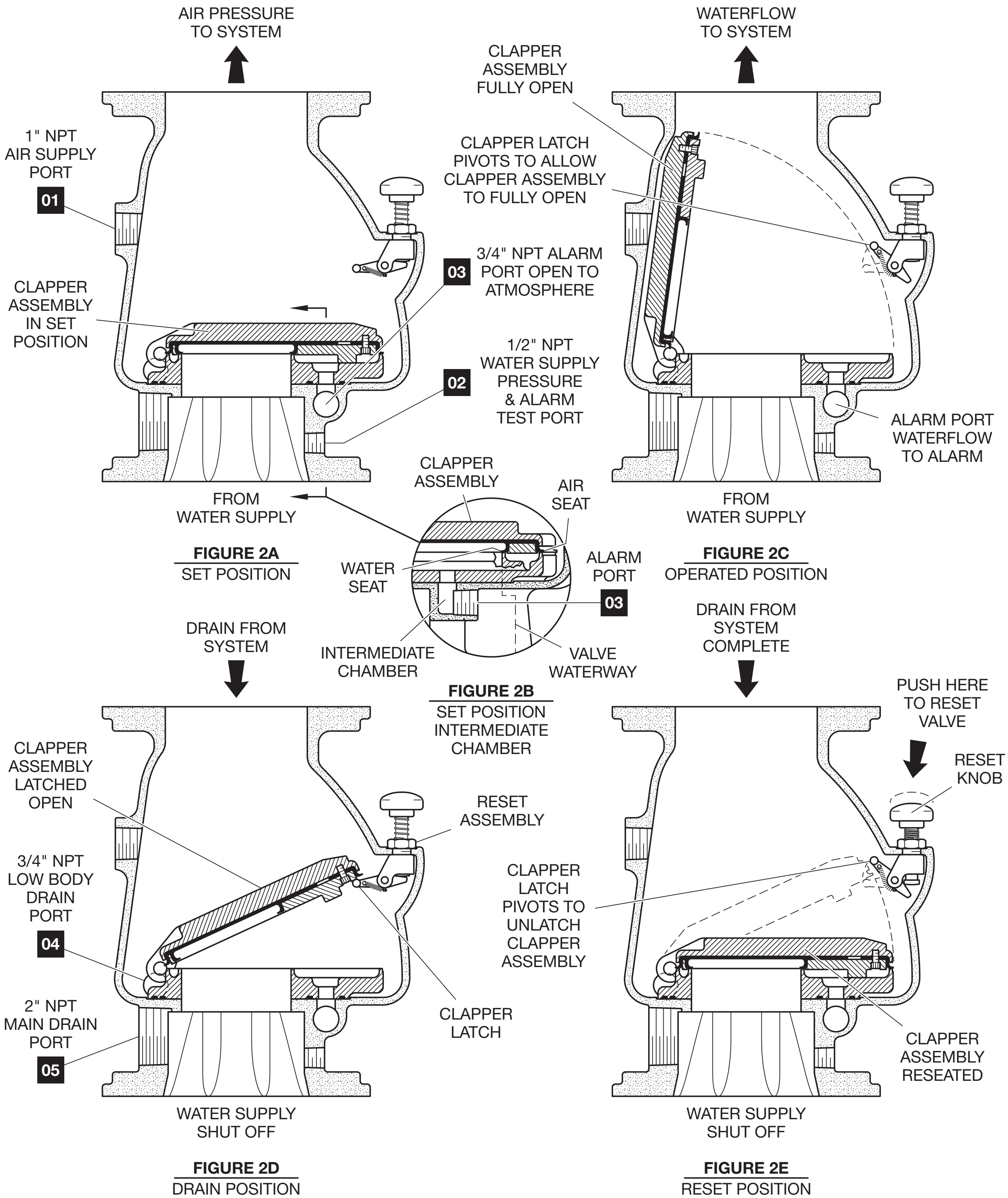


FIGURE 2- PART 2 OF 2
MODEL DPV-1 DRY PIPE VALVES
6 INCH (DN150)
SET AND OPEN POSITIONS

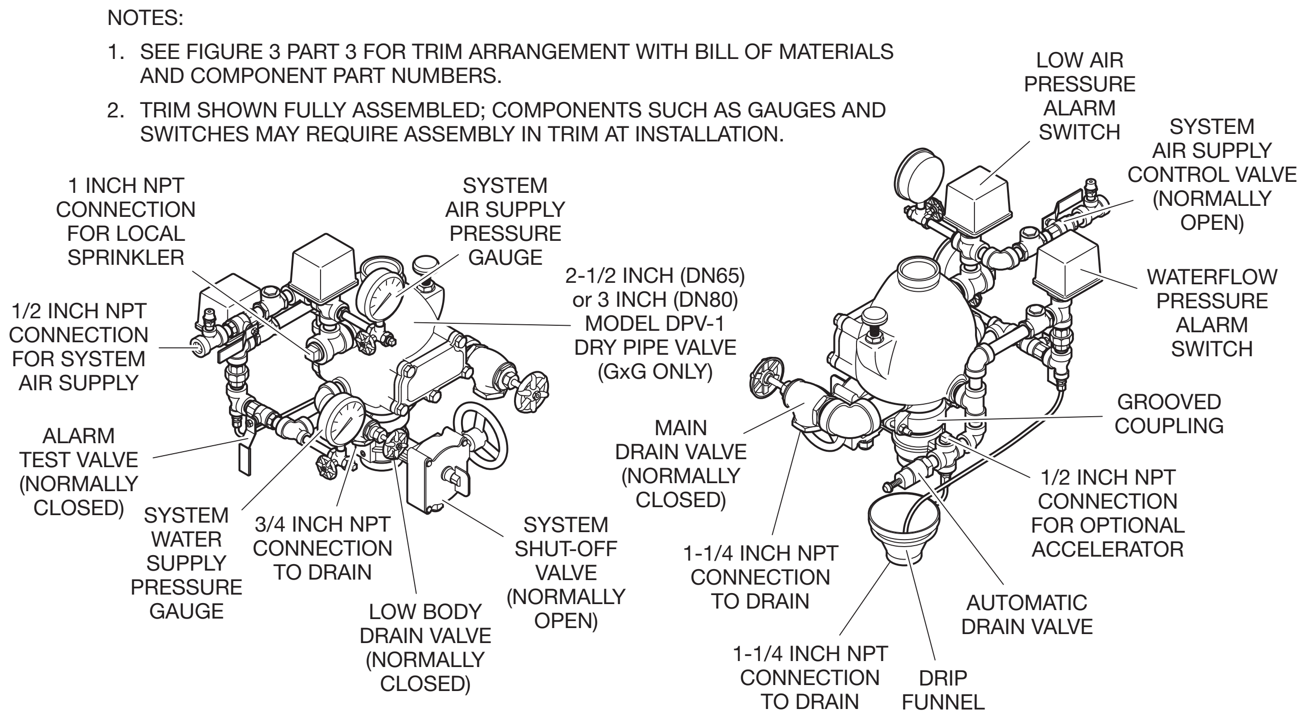


FIGURE 3 - PART 1 OF 3
2-1/2 AND 3 INCH (DN65 AND DN80) MODEL DPV-1 DRY PIPE VALVE
PRE-TRIMMED ASSEMBLY

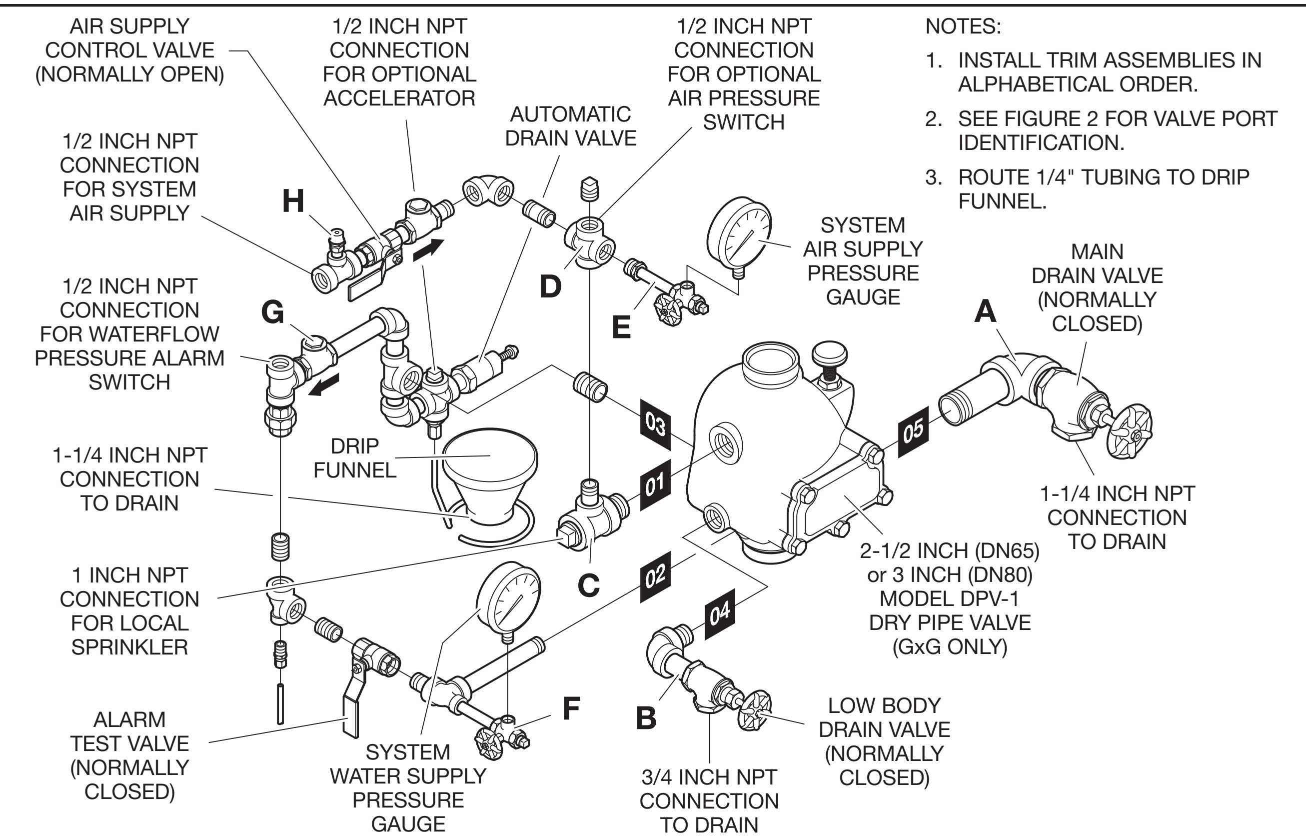
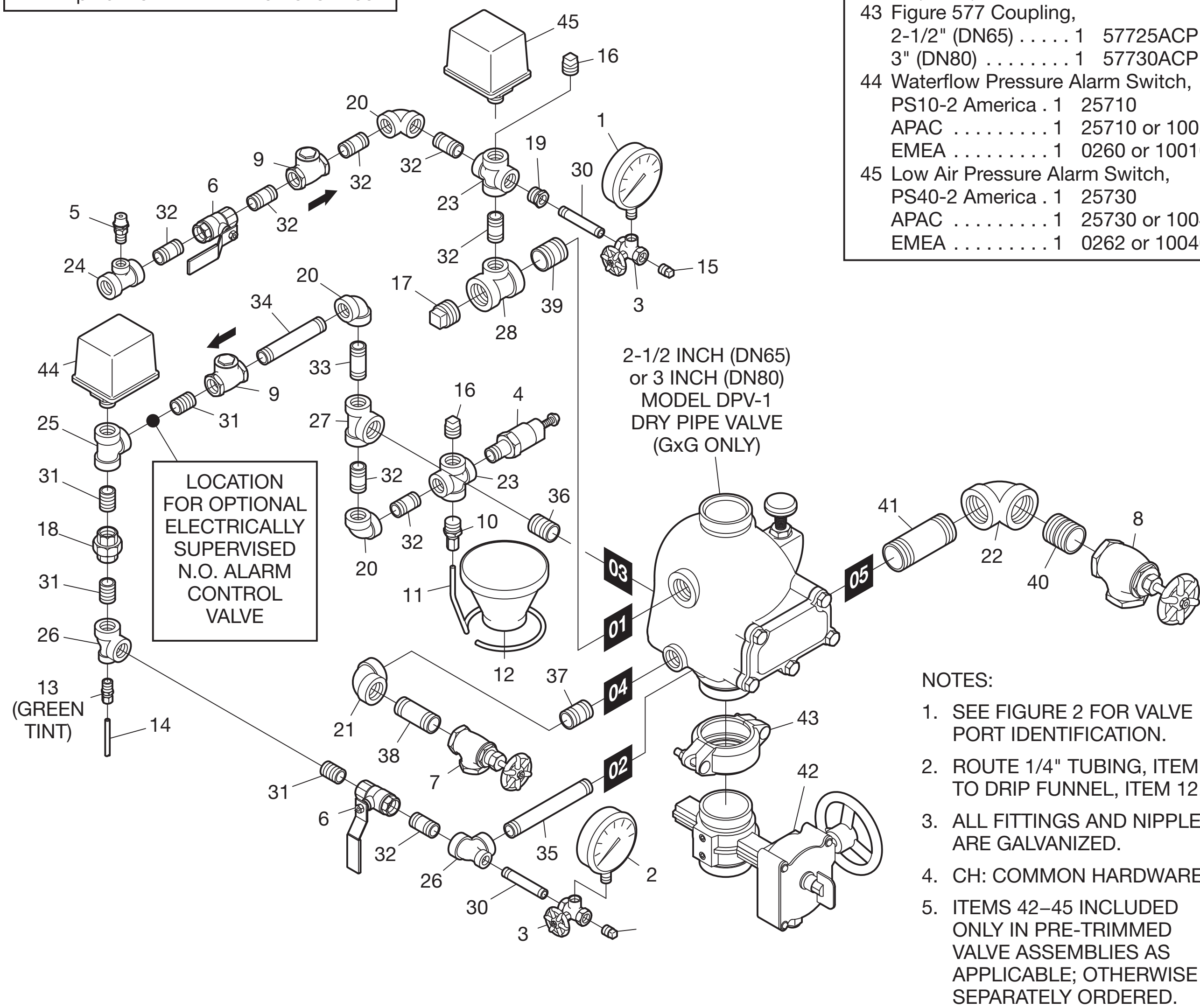


FIGURE 3 - PART 2 OF 3
2-1/2 AND 3 INCH (DN65 AND DN80) MODEL DPV-1 DRY PIPE VALVE
EXPLODED ARRANGEMENT OF SEMI-ASSEMBLED TRIM

NO.	DESCRIPTION	QTY	P/N
1	250 psi/ 1750 kPa Air Pressure Gauge	1	92-343-1-012
2	300 psi/ 2000 kPa Water Pressure Gauge	1	92-343-1-005
3	1/4" Gauge Test Valve	2	46-005-1-002
4	Model AD-1 Automatic Drain Valve	1	52-793-2-004
5	1/4" Pressure Relief Valve	1	92-343-1-020
6	1/2" Ball Valve	2	46-050-1-004
7	3/4" Angle Valve	1	46-048-1-005
8	1-1/4" Angle Valve	1	46-048-1-007
9	1/2" Swing Check Valve	2	46-049-1-004
10	Drip Funnel Connector	1	92-211-1-005
11	Drip Funnel Bracket	1	92-211-1-003
12	Drip Funnel	1	92-343-1-007

NO.	DESCRIPTION	QTY	P/N
13	3/32" Vent Fitting	1	92-032-1-002
14	1/4" Tube, 18" Long	1	CH
15	1/4" Plug	2	CH
16	1/2" Plug	2	CH
17	1" Plug	1	CH
18	1/2" Union	1	CH
19	1/2" x 1/4" Reducing Bushing	1	CH
20	1/2" 90° Elbow	3	CH
21	3/4" 90° Elbow	1	CH
22	1-1/4" 90° Elbow	1	CH
23	1/2" Cross	2	CH
24	1/2" x 1/2" x 1/4" Reducing Tee	1	CH
25	1/2" Tee	1	CH
26	1/2" x 1/4" x 1/2" Reducing Tee	2	CH
27	1/2" x 1/2" x 3/4" Reducing Tee	1	CH

NO.	DESCRIPTION	QTY	P/N
28	1" x 1" x 1/2" Reducing Tee	1	CH
29	Not Used		
PIPE NIPPLES:			
30	1/4" x 3"	2	CH
31	1/2" x Close	4	CH
32	1/2" x 1-1/2"	8	CH
33	1/2" x 2"	1	CH
34	1/2" x 4-1/2"	1	CH
35	1/2" x 6"	1	CH
36	3/4" x Close	1	CH
37	3/4" x 1-1/2"	1	CH
38	3/4" x 2-1/2"	1	CH
39	1" x Close	1	CH
40	1-1/4" x Close	1	CH
41	1-1/4" x 4"	1	CH
COMPONENTS INCLUDED ONLY IN PRE-TRIMMED VALVE ASSEMBLIES:			
42	Model BFV-300 Butterfly Valve,		
	2-1/2" (DN65)	1	59300G025WS
	3" (DN80)	1	59300G030WS
43	Figure 577 Coupling,		
	2-1/2" (DN65)	1	57725ACP
	3" (DN80)	1	57730ACP
44	Waterflow Pressure Alarm Switch,		
	PS10-2 America	1	25710
	APAC	1	25710 or 100102
	EMEA	1	0260 or 100101
45	Low Air Pressure Alarm Switch,		
	PS40-2 America	1	25730
	APAC	1	25730 or 100402
	EMEA	1	0262 or 100401



NOTES:

1. SEE FIGURE 2 FOR VALVE PORT IDENTIFICATION.
2. ROUTE 1/4" TUBING, ITEM 14, TO DRIP FUNNEL, ITEM 12.
3. ALL FITTINGS AND NIPPLES ARE GALVANIZED.
4. CH: COMMON HARDWARE
5. ITEMS 42–45 INCLUDED ONLY IN PRE-TRIMMED VALVE ASSEMBLIES AS APPLICABLE; OTHERWISE SEPARATELY ORDERED.

FIGURE 3 - PART 3 OF 3
2-1/2 AND 3 INCH (DN65 AND DN80) MODEL DPV-1 DRY PIPE VALVE
EXPLODED ARRANGEMENT OF VALVE TRIM

1. SEE FIGURE 4 PART 3 FOR TRIM ARRANGEMENT WITH BILL OF MATERIALS AND COMPONENT PART NUMBERS.
2. TRIM SHOWN FULLY ASSEMBLED; COMPONENTS SUCH AS GAUGES AND SWITCHES MAY REQUIRE ASSEMBLY IN TRIM AT INSTALLATION.

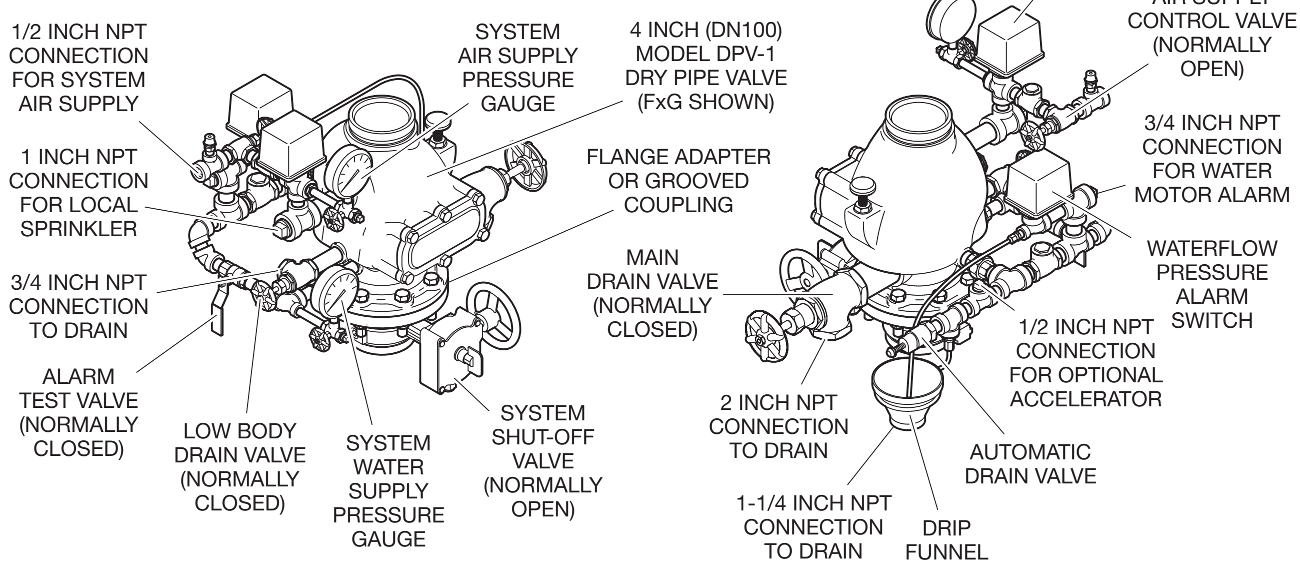
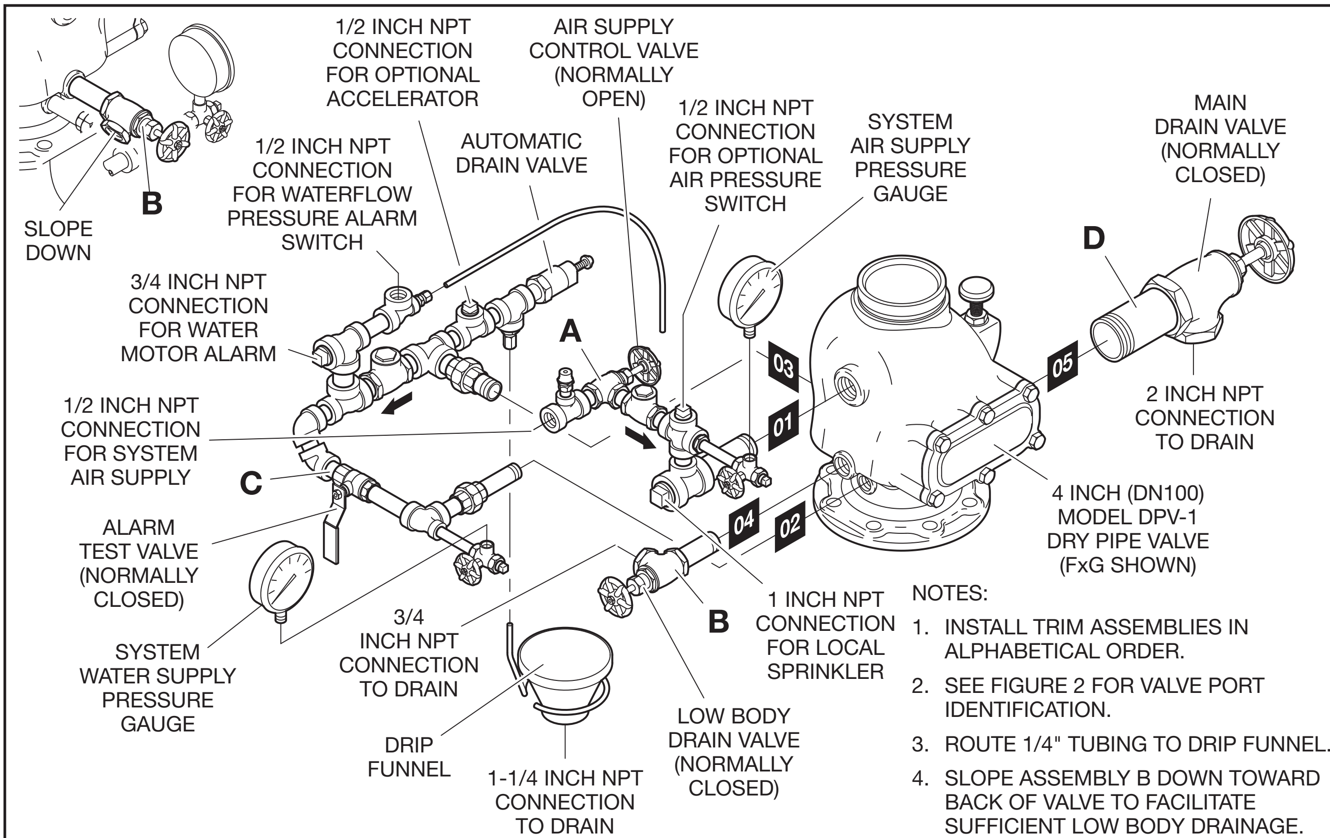
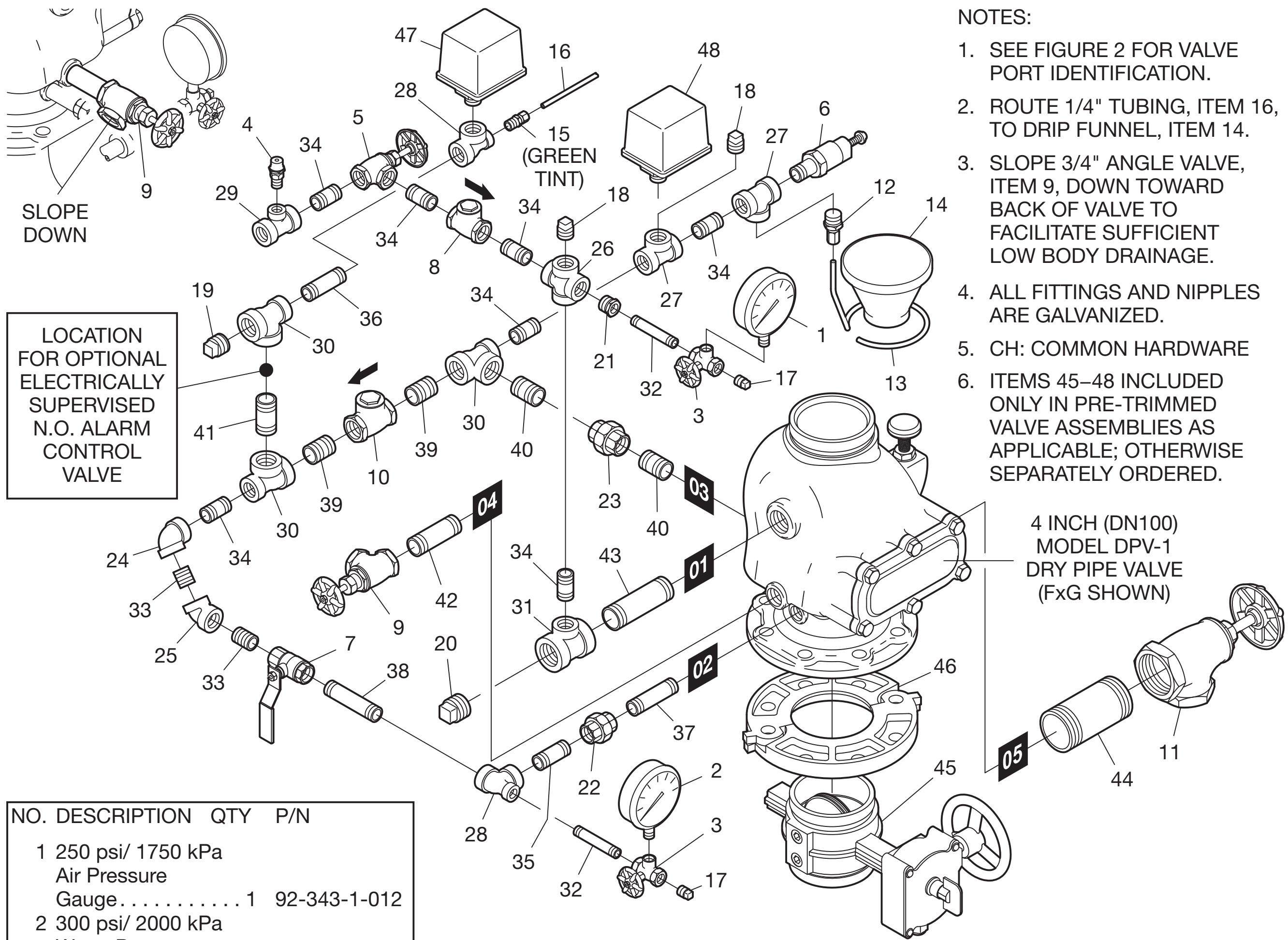


FIGURE 4 - PART 1 OF 3
4 INCH (DN100) MODEL DPV-1 DRY PIPE VALVE
PRE-TRIMMED ASSEMBLY



NOTES:
1. INSTALL TRIM ASSEMBLIES IN ALPHABETICAL ORDER.
2. SEE FIGURE 2 FOR VALVE PORT IDENTIFICATION.
3. ROUTE 1/4" TUBING TO DRIP FUNNEL.
4. SLOPE ASSEMBLY B DOWN TOWARD BACK OF VALVE TO FACILITATE SUFFICIENT LOW BODY DRAINAGE.

FIGURE 4 - PART 2 OF 3
4 INCH (DN100) MODEL DPV-1 DRY PIPE VALVE
EXPLODED ARRANGEMENT OF SEMI-ASSEMBLED TRIM



NOTES:

1. SEE FIGURE 2 FOR VALVE PORT IDENTIFICATION.
2. ROUTE 1/4" TUBING, ITEM 16, TO DRIP FUNNEL, ITEM 14.
3. SLOPE 3/4" ANGLE VALVE, ITEM 9, DOWN TOWARD BACK OF VALVE TO FACILITATE SUFFICIENT LOW BODY DRAINAGE.
4. ALL FITTINGS AND NIPPLES ARE GALVANIZED.
5. CH: COMMON HARDWARE
6. ITEMS 45–48 INCLUDED ONLY IN PRE-TRIMMED VALVE ASSEMBLIES AS APPLICABLE; OTHERWISE SEPARATELY ORDERED.

NO.	DESCRIPTION	QTY	P/N
1	250 psi/ 1750 kPa Air Pressure Gauge	1	92-343-1-012
2	300 psi/ 2000 kPa Water Pressure Gauge	1	92-343-1-005
3	1/4" Gauge Test Valve	2	46-005-1-002
4	1/4" Pressure Relief Valve	1	92-343-1-020
5	1/2" Angle Valve	1	46-048-1-004
6	Model AD-1 Automatic Drain Valve	1	52-793-2-004
7	1/2" Ball Valve	1	46-050-1-004
8	1/2" Swing Check Valve	1	46-049-1-004
9	3/4" Angle Valve	1	46-048-1-005
10	3/4" Swing Check Valve	1	46-049-1-005
11	2" Angle Valve	1	46-048-1-009
12	Drip Funnel Connector	1	92-211-1-005
13	Drip Funnel Bracket	1	92-211-1-003
14	Drip Funnel	1	92-343-1-007
15	3/32" Vent Fitting	1	92-032-1-002
16	1/4" Tube, 24" Long	1	CH
17	1/4" Plug	2	CH
18	1/2" Plug	2	CH
19	3/4" Plug	1	CH

NO.	DESCRIPTION	QTY	P/N
20	1" Plug	1	CH
21	1/2" x 1/4" Reducing Bushing	1	CH
22	1/2" Union	1	CH
23	3/4" Union	1	CH
24	1/2" 90° Elbow	1	CH
25	1/2" 45° Elbow	1	CH
26	1/2" Cross	1	CH
27	1/2" Tee	2	CH
28	1/2" x 1/4" x 1/2" Reducing Tee	2	CH
29	1/2" x 1/2" x 1/4" Reducing Tee	1	CH
30	3/4" x 1/2" x 3/4" Reducing Tee	3	CH
31	1" x 1" x 1/2" Reducing Tee	1	CH
PIPE NIPPLES:			
32	1/4" x 3"	2	CH
33	1/2" x Close	2	CH
34	1/2" x 1-1/2"	7	CH
35	1/2" x 2"	1	CH
36	1/2" x 2-1/2"	1	CH
37	1/2" x 3"	1	CH
38	1/2" x 3-1/2"	1	CH
39	3/4" x Close	2	CH

NO.	DESCRIPTION	QTY	P/N
40	3/4" x 1-1/2"	2	CH
41	3/4" x 2"	1	CH
42	3/4" x 3"	1	CH
43	1" x 4"	1	CH
44	2" x 4-1/2"	1	CH
COMPONENTS INCLUDED ONLY IN PRE-TRIMMED VALVE ASSEMBLIES:			
45	Model BFV-300 Butterfly Valve, 4" (DN100)	1	59300G040WS
46	Butterfly Valve Assembly Component: GxG DPV-1 Valves, Figure 577 Coupling, 4" (DN100)	1	57740ACP
	FxF, FxG DPV-1 Valves, Figure 71 Flange Adapter, 4" (DN100)	1	7140S
47	Waterflow Pressure Alarm Switch, PS10-2 America	1	25710
	APAC	1	25710 or 100102
	EMEA	1	0260 or 100101
48	Low Air Pressure Alarm Switch, PS40-2 America	1	25730
	APAC	1	25730 or 100402
	EMEA	1	0262 or 100401

FIGURE 4 - PART 3 OF 3
4 INCH (DN100) MODEL DPV-1 DRY PIPE VALVE
EXPLODED ARRANGEMENT OF VALVE TRIM

NOTES:

1. SEE FIGURE 5 PART 3 FOR TRIM ARRANGEMENT WITH BILL OF MATERIALS AND COMPONENT PART NUMBERS.
2. TRIM SHOWN FULLY ASSEMBLED; COMPONENTS SUCH AS GAUGES AND SWITCHES MAY REQUIRE ASSEMBLY IN TRIM AT INSTALLATION.

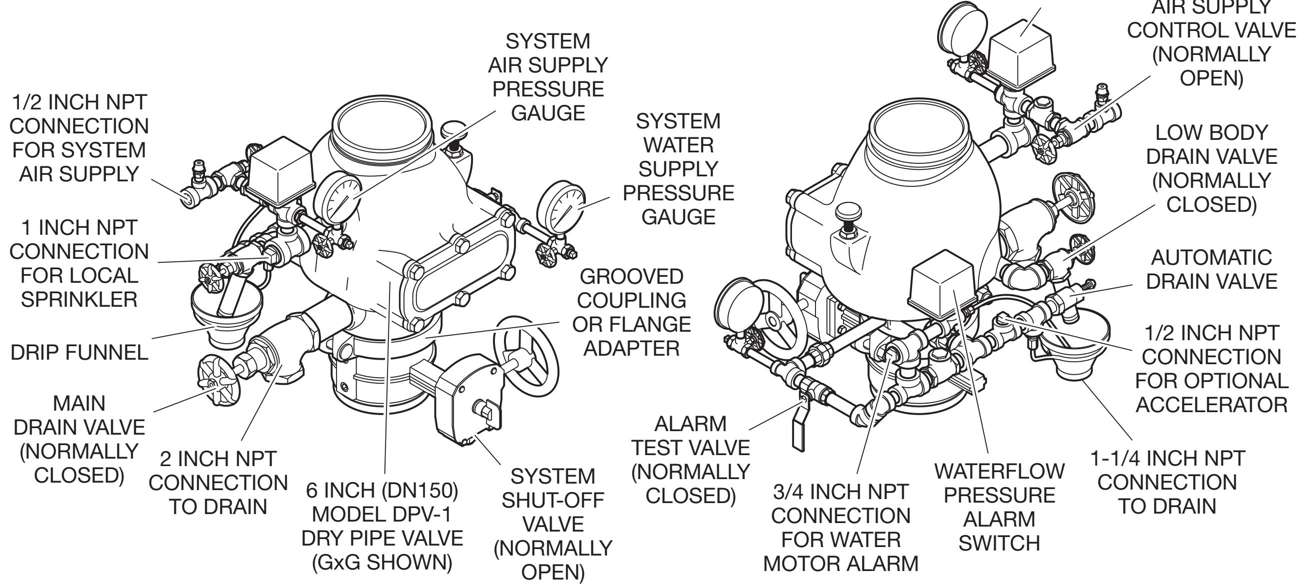
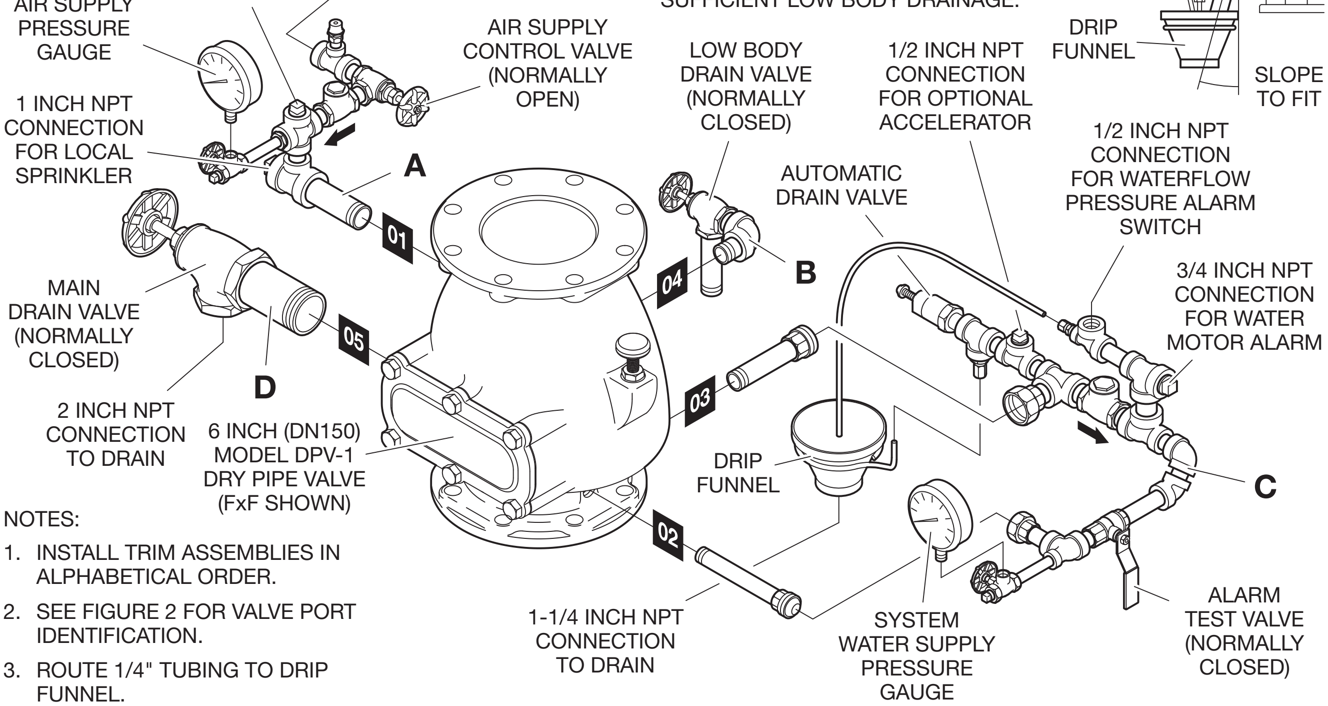


FIGURE 5 - PART 1 OF 3
6 INCH (DN150) MODEL DPV-1 DRY PIPE VALVE
PRE-TRIMMED ASSEMBLY

NOTES:

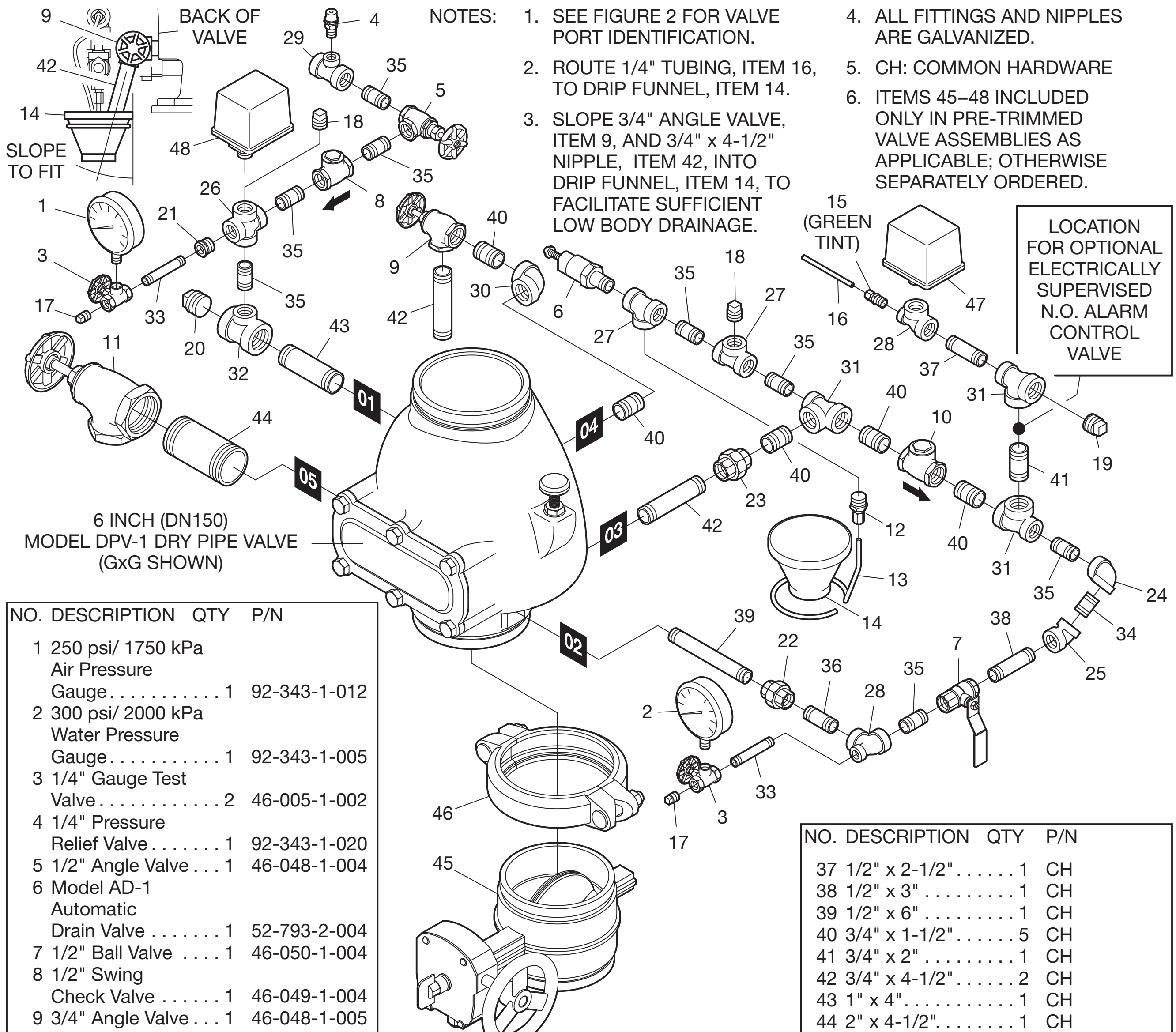
4. SLOPE 3/4" ANGLE VALVE AND 3/4" x 4-1/2" NIPPLE (OF ASSEMBLY B) INTO DRIP FUNNEL TO FACILITATE SUFFICIENT LOW BODY DRAINAGE.



NOTES:

1. INSTALL TRIM ASSEMBLIES IN ALPHABETICAL ORDER.
2. SEE FIGURE 2 FOR VALVE PORT IDENTIFICATION.
3. ROUTE 1/4" TUBING TO DRIP FUNNEL.

FIGURE 5 - PART 2 OF 3
6 INCH (DN150) MODEL DPV-1 DRY PIPE VALVE
EXPLODED ARRANGEMENT OF SEMI-ASSEMBLED TRIM



NOTES:

1. SEE FIGURE 2 FOR VALVE PORT IDENTIFICATION.
2. ROUTE 1/4" TUBING, ITEM 16, TO DRIP FUNNEL, ITEM 14.
3. SLOPE 3/4" ANGLE VALVE, ITEM 9, AND 3/4" x 4-1/2" NIPPLE, ITEM 42, INTO DRIP FUNNEL, ITEM 14, TO FACILITATE SUFFICIENT LOW BODY DRAINAGE.
4. ALL FITTINGS AND NIPPLES ARE GALVANIZED.
5. CH: COMMON HARDWARE
6. ITEMS 45–48 INCLUDED ONLY IN PRE-TRIMMED VALVE ASSEMBLIES AS APPLICABLE; OTHERWISE SEPARATELY ORDERED.

NO.	DESCRIPTION	QTY	P/N
1	250 psi/ 1750 kPa Air Pressure Gauge	1	92-343-1-012
2	300 psi/ 2000 kPa Water Pressure Gauge	1	92-343-1-005
3	1/4" Gauge Test Valve	2	46-005-1-002
4	1/4" Pressure Relief Valve	1	92-343-1-020
5	1/2" Angle Valve	1	46-048-1-004
6	Model AD-1 Automatic Drain Valve	1	52-793-2-004
7	1/2" Ball Valve	1	46-050-1-004
8	1/2" Swing Check Valve	1	46-049-1-004
9	3/4" Angle Valve	1	46-048-1-005
10	3/4" Swing Check Valve	1	46-049-1-005
11	2" Angle Valve	1	46-048-1-009
12	Drip Funnel Connector	1	92-211-1-005
13	Drip Funnel Bracket	1	92-211-1-003
14	Drip Funnel	1	92-343-1-007
15	3/32" Vent Fitting	1	92-032-1-002
16	1/4" Tube, 24" Long	1	CH
17	1/4" Plug	2	CH
18	1/2" Plug	2	CH
19	3/4" Plug	1	CH
20	1" Plug	1	CH
21	1/2" x 1/4" Reducing Bushing	1	CH
22	1/2" Union	1	CH
23	3/4" Union	1	CH
24	1/2" 90° Elbow	1	CH

NO.	DESCRIPTION	QTY	P/N
25	1/2" 45° Elbow	1	CH
26	1/2" Cross	1	CH
27	1/2" Tee	2	CH
28	1/2" x 1/4" x 1/2" Reducing Tee	2	CH
29	1/2" x 1/2" x 1/4" Reducing Tee	1	CH
30	3/4" 90° Elbow	1	CH
31	3/4" x 1/2" x 3/4" Reducing Tee	3	CH
32	1" x 1" x 1/2" Reducing Tee	1	CH
PIPE NIPPLES:			
33	1/4" x 3"	2	CH
34	1/2" x Close	1	CH
35	1/2" x 1-1/2"	8	CH
36	1/2" x 2"	1	CH

NO.	DESCRIPTION	QTY	P/N
37	1/2" x 2-1/2"	1	CH
38	1/2" x 3"	1	CH
39	1/2" x 6"	1	CH
40	3/4" x 1-1/2"	5	CH
41	3/4" x 2"	1	CH
42	3/4" x 4-1/2"	2	CH
43	1" x 4"	1	CH
44	2" x 4-1/2"	1	CH
COMPONENTS INCLUDED ONLY IN PRE-TRIMMED VALVE ASSEMBLIES:			
45	Model BFV-300 Butterfly Valve, 6" (DN150)	1	59300G060WS
46	Butterfly Valve Assembly Component:		
	GxG DPV-1 Valves, Figure 577 Coupling, 6" (DN150)	1	57760ACP
	FxF, FxG DPV-1 Valves, Figure 71 Flange Adapter, 6" (DN150)	1	7160S
47	Waterflow Pressure Alarm Switch,		
	PS10-2 America	1	25710
	APAC	1	25710 or 100102
	EMEA	1	0260 or 100101
48	Low Air Pressure Alarm Switch,		
	PS40-2 America	1	25730
	APAC	1	25730 or 100402
	EMEA	1	0262 or 100401

FIGURE 5 - PART 3 OF 3
6 INCH (DN150) MODEL DPV-1 DRY PIPE VALVE
EXPLODED ARRANGEMENT OF VALVE TRIM

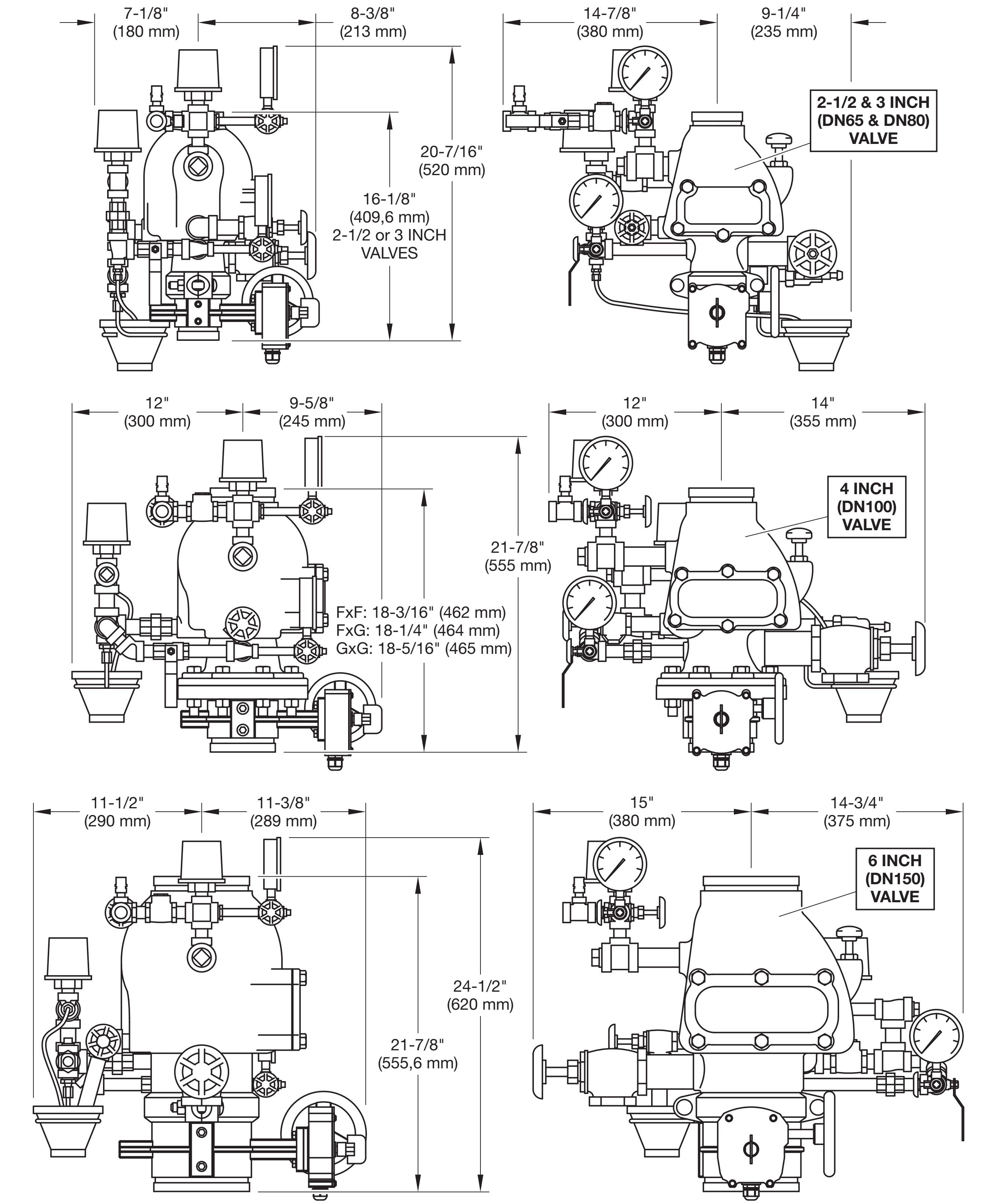


FIGURE 6 - PART 1 OF 2
MODEL DPV-1 DRY PIPE VALVE
INSTALLATION DIMENSIONS, PRE-TRIMMED VALVE

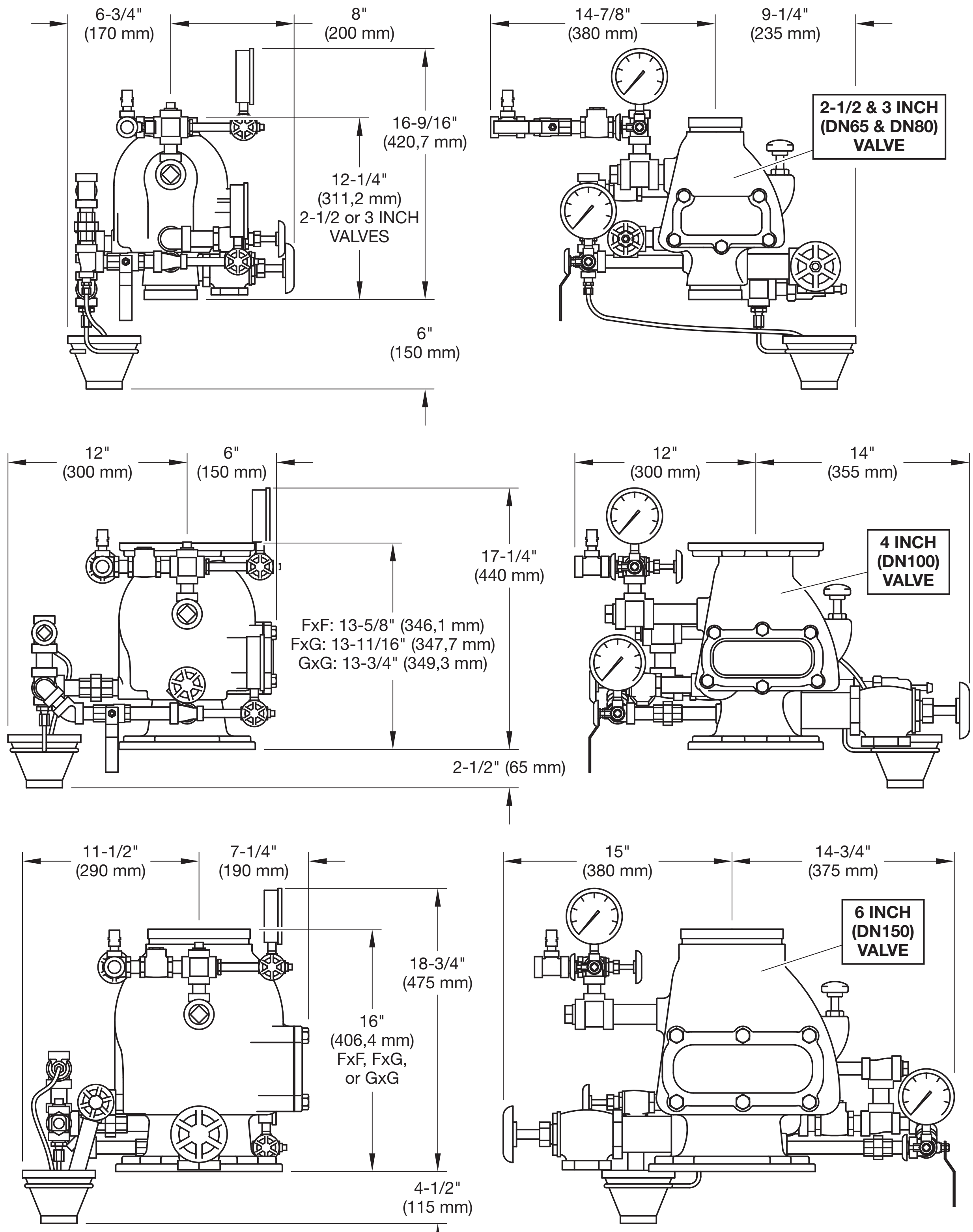


FIGURE 6 - PART 2 OF 2
MODEL DPV-1 DRY PIPE VALVE
INSTALLATION DIMENSIONS, VALVE AND SEMI-ASSEMBLED TRIM

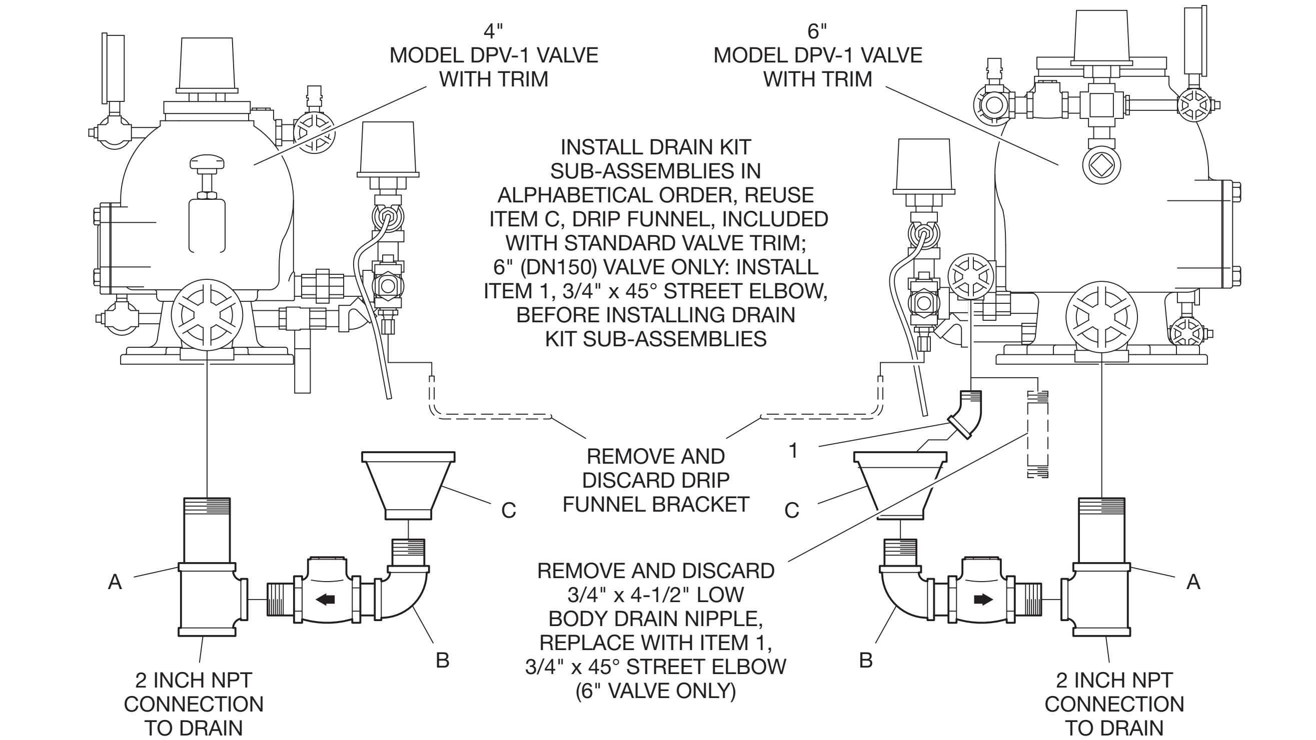


FIGURE 7
OPTIONAL DRAIN KIT INSTALLATION

Care and Maintenance

The following procedures and inspections should be performed as indicated, in addition to any specific requirements of the NFPA, and any impairment must be immediately corrected.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and notify all personnel who may be affected by action.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the NFPA such as NFPA 25, in addition to the standards of any authority having jurisdiction. Contact the installing contractor or sprinkler manufacturer regarding any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified inspection service in accordance with local requirements and/or national codes.

The operational test procedure and waterflow pressure alarm test procedure will result in operation of the associated alarms. Consequently, notification must first be given to the owner and the fire department, central station, or other signal station to which the alarms are connected.

Annual Operation Test Procedure
Note: *Unless otherwise noted, see Figure 3, 4, or 5 to identify functional trim components.*

Proper operation of the DPV-1 valve — for example, opening of the DPV-1 valve during a fire condition — should be verified at least once a year as follows:

Step 1. If necessary, prevent water from flowing beyond the riser by performing the following steps:

- **a.** Close the main control valve.
- **b.** Open the main drain valve.
- **c.** Open the main control valve one turn beyond the position at which water just begins to flow from the main drain valve.
- **d.** Close the main drain valve.

Step 2. Open the system inspector's test connection.

Step 3. Verify that the DPV-1 valve has operated, as indicated by the flow of water into the system and that all waterflow alarms operate properly.

Step 4. Close the system main control valve.

Step 5. Reset the DPV-1 valve in accordance with the Valve Setting Procedure.

Note: *It is recommended that the requirement of NFPA 25 to annually inspect the inside of the valve be performed at this time and prior to resetting the DPV-1 valve. Refer to the Automatic Drain Valve Inspection subsection Steps 2 through 5 for instructions with regard to the inspection of the clapper facing.*

Quarterly Waterflow Alarm Test Procedure
Testing of the system waterflow alarms should be performed quarterly. To test the waterflow alarm, open the alarm test valve, which will allow a flow of water to the waterflow pressure alarm switch and/or water motor alarm. Upon satisfactory completion of the test, close the alarm test valve.

Nominal Valve Sizes in. (DN)	Handhole Cover Bolt Torque lb-ft (N·m)
2-1/2 (DN65)	20 (27)
3 (DN80)	20 (27)
4 (DN100)	20 (27)
6 (DN150)	45 (61)

TABLE C
HANDHOLE COVER BOLTS RECOMMENDED TORQUE

Water Pressure Inspection
The water pressure gauge is to be inspected monthly (per NFPA 25) to ensure that normal system water pressure is being maintained.

Air Pressure Inspection
The air pressure gauge is to be inspected monthly (per NFPA 25) to ensure that normal system air pressure is being maintained.

Automatic Drain Valve Inspection
The automatic drain valve should be inspected monthly (per NFPA 25) by depressing the plunger and checking to ensure that the automatic drain valve is not discharging water and/or air. A discharge of water and/or air is an indication that the air and/or water seats are leaking, which could subsequently cause a false operation should the intermediate chamber become inadvertently pressurized.

If leakage is present, take the DPV-1 valve out of service (for example, close the main control valve, open the main drain valve, close the air supply control valve, remove the dry pipe valve accelerator from service, as applicable, in accordance with the Technical Data Sheet (TDS) instructions, (refer to TDS TFP1105 for the VIZOR or TDS TFP1112 for the ACC-1), and open the inspector's test connection to relieve the system air pressure to 0 psi (0 bar) as indicated on the system air pressure gauge), and then after removing the handhole cover, perform the following steps:

Step 1. Make sure that the seat ring is clean and free of any nicks or significant scratches.

Step 2. Remove the clapper assembly from the valve by first pulling out the hinge pin.

Step 3. Disassemble the clapper facing retainer from the clapper so that the clapper facing can be removed and inspected. Make sure that the clapper facing does not show signs of compression set, damage, etc. Replace the clapper facing if there is any signs of wear.

Step 4. Clean the clapper facing, clapper, and clapper facing retainer, and then reassemble the clapper assembly.

Step 5. Reinstall the clapper assembly with its hinge pin.

Step 6. Install the handhole cover:

a. Align the handhole cover gasket and handhole cover in the proper orientation with the valve body as shown in Figure 1, and hold in place.

b. Apply LOCTITE No. 242 or equivalent to the Hex Bolt threads.

c. Insert the Hex Bolts through the handhole cover gasket and handhole cover, and hand-tighten into the valve body.

d. Using a crossdraw sequence to assure uniformity, wrench-tighten the hex bolts to the recommended torque values as shown in Table C.

e. Inspect to assure all the hex bolts are securely tightened.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order indicate the full product name and Part Number (P/N).

Standard DPV-1 Dry Pipe Valve
ANSI standard outside diameter (O.D.) pipe size with grooved or ANSI drilled flange end connections and NPT threaded ports.

Specify: (specify size) Model DPV-1 Dry Pipe Valve with (specify) End Connections, P/N (specify):

Groove x Groove,
ANSI 2.88 in. (73,1 mm) O.D. Grooves:
2-1/2 in. (DN65) G x G 52-312-1-925
Groove x Groove,
ANSI 3.50 in. (88,9 mm) O.D. Grooves:
3 in. (DN80) G x G 52-312-1-930
Groove x Groove,
ANSI 4.50 in. (114,3 mm) O.D. Grooves:
4 in. (DN100) G x G 52-312-1-940
Flange x Groove,
ANSI Flange x ANSI 4.50 in. (114,3 mm) O.D. Groove:
4 in. (DN100) F x G. 52-312-1-440
Flange x Flange,
ANSI Flanges:
4 in. (DN100) F x F 52-312-1-040
Groove x Groove,
ANSI 6.62 in. (168,3 mm) O.D. Grooves:
6 in. (DN150) G x G. 52-312-1-960
Flange x Groove,
ANSI Flange x ANSI 6.62 in. (168,3 mm) O.D. Groove:
6 in. (DN150) F x G. 52-312-1-460
Flange x Flange,
ANSI Flanges:
6 in. (DN150) F x F 52-312-1-060

Pre-Trimmed DPV-1 Assemblies with Butterfly Valve
Specify: 2-1/2 in. DPV-1 Pre-Trimmed Valve Assembly, Grooved End Connections, P/N 52-310-3-925

Specify: 3 in. DPV-1 Pre-Trimmed Valve Assembly, Grooved End Connections, P/N 52-310-3-930

Specify: 4 in. DPV-1 Pre-Trimmed Valve Assembly, (specify) End Connection, P/N (specify):

Flange x Flange 52-310-3-040
Flange x Groove. 52-310-3-440
Groove x Groove 52-310-3-940

Specify: 6 in. DPV-1 Pre-Trimmed Valve Assembly, (specify) End Connection, P/N (specify):

Flange x Flange 52-310-3-060
Flange x Groove. 52-310-3-460
Groove x Groove 52-310-3-960

Pre-Trimmed DPV-1 Assemblies without Butterfly Valve
Specify: 4 in. DPV-1 Pre-Trimmed Valve Assembly without Butterfly, (specify) End Connection, P/N (specify):

Flange x Flange 52-310-4-040
Flange x Groove. 52-310-4-440

Specify: 6 in. DPV-1 Pre-Trimmed Valve Assembly without Butterfly, (specify) End Connection, P/N (specify):

Flange x Flange 52-310-4-060
Flange x Groove. 52-310-4-460

Standard Galvanized Semi-Assembled DPV-1 Trim
Note: *Valves with NPT threaded ports are intended for use with the Standard Galvanized Semi-Assembled DPV-1 Valve Trim as described in Figures 3, 4 and 5 of this document.*

Specify: 2-1/2 and 3 in. DPV-1 Semi-Assembled Galvanized Trim, P/N 52-309-2-005

Specify: 4 in. DPV-1 Semi-Assembled Galvanized Trim, P/N 52-309-2-001

Specify: 6 in. DPV-1 Semi-Assembled Galvanized Trim, P/N 52-309-2-002

Optional Drain Kit
Includes swing check valve, fittings and pipe nipples to connect the drip funnel directly to the main drain in 4 and 6 in. valve trim assemblies as shown in Figure 7.

Specify: Universal Model DPV-1 Dry Pipe Valve Drain Kit, 4 in. and 6 in. Valves, P/N 52-309-2-106

Drain Kit Replacement Check Valve
Specify: Swing Check Valve, 1-1/4 in., P/N 46-049-1-006

Optional Electronic Accelerator: VIZOR Electronic Dry Pipe Accelerator (with Trim)
Refer to Technical Data Sheet TFP1105.

Specify: VIZOR Electronic Dry Pipe Accelerator for use with the 4 or 6 in. TYCO Model DPV-1 Dry Pipe Valve Trim, P/N 52-312-3-001

Optional Mechanical Accelerator: Model ACC-1 Dry Pipe Accelerator
Refer to Technical Data Sheet TFP1112.

Specify: Model ACC-1 Dry Pipe Accelerator, P/N 52-311-1-001, and Galvanized Accelerator Trim for Model DPV-1 Dry Pipe Valve, P/N 52-311-2-010

Optional 600 PSI Water Pressure Gauge:
Specify: 600 PSI Water Pressure Gauge, P/N 92-343-1-004

Accessories
Refer to Technical data Sheets describing the following accessories, as applicable.

Specify: Description, P/N (specify):

Waterflow Pressure Alarm Switch
PS10-2 (America). 25710
(APAC) . . . . 25710 or 100102
(EMEA) . . . . 0260 or 100101
Low Air Pressure Alaram Switch
PS40-2 25730
(APAC) . . . . 25730 or 100402
(EMEA) . . . . 0262 or 100401
Model WMA-1
Water Motor Alarm. 52-630-1-001
(Refer to Technical Data Sheet TFP921)
Model AMD-1
Air Maintenance Device. 52-324-2-002
(Refer to Technical Data Sheet TFP1221)
Model AMD-2
Air Maintenance Device. 52-326-2-001
(Refer to Technical Data Sheet TFP1231)
Model AMD-3
Nitrogen Maintenance Device. . . .52-328-2-001
(Refer to Technical Data Sheet TFP1241)

Replacement Valve Parts
Specify: (description) for use with (specify size) Model DPV-1 Dry Pipe Valve, P/N, see Figure 1.

Replacement Trim Parts
Specify: (description) for use with (specify size) Model DPV-1 Dry Pipe Valve, P/N, see Figures 3, 4, or 5.

Other DPV-1 Dry Pipe Valves
Notes: *Other DPV-1 Dry Pipe Valves are valves ordered with any combination of flange drilling, pipe groove outside diameter (O.D.), or port thread specification not offered as Standard DPV-1 Dry Pipe Valves.*

Valves with NPT threaded ports are intended for use with the Standard Galvanized Semi-Assembled DPV-1 Valve Trim described in Figures 3, 4 and 5. Valves with ISO threaded ports are intended for use with special order trim that is provided by local distributors to meet the specific needs of certain localities. Please contact your local distributor regarding valves and valve trim for specific localities.

Specify: (specify size) Model DPV-1 Dry Pipe Valve with (specify) End Connections and (specify NPT or ISO) threaded ports

1467 Elmwood Avenue, Cranston, RI 02910 | Telephone +1-401-781-8220

Johnson Controls

Model ACC-1 Dry Pipe Valve Accelerator External Resetting Quick Opening Device For Dry Pipe Valves

IMPORTANT
Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp1112

General Description

The TYCO Model ACC-1 Dry Pipe Valve Accelerator is a quick opening device intended for attachment to the TYCO, 2-1/2, 3, 4 or 6 inch Model DPV-1 Dry Pipe Valve. The ACC-1 accelerator reduces the time for valve operation following the operation of one or more automatic sprinklers.

The ACC-1 accelerator automatically adjusts to both small and slow changes in system pressure, but trips when there is a rapid and steady drop in pressure (as in the case of a sprinkler operation). Upon tripping, the accelerator transmits system air pressure to the intermediate chamber of the Model DPV-1 Dry Pipe Valve. This neutralizes the differential pressure holding the dry pipe valve closed and permits it to open.

The ACC-1 accelerator has a unique, positive action, internal anti- flood device and a ball float which combine to prevent water and water borne debris from entering the more sensitive operating areas of the accelerator. The anti-flood device seals and latches immediately upon operation of the accelerator without waiting for a pressure build-up in the intermediate chamber of the dry pipe valve. The latching feature keeps the anti-flood device sealed, even while the system is being drained. The ball float seals the pilot chamber inlet port if there is an inadvertent trip of the dry pipe valve, due for example, to an air compressor failure combined with a slow loss in system air pressure due to a leak.

The Model ACC-1 Dry Pipe Valve Accelerator is a direct replacement for the Central Model B, Gem Model F311, and Star Model S430. Contact the Technical Services Department for information concerning the use of the ACC-1 for use with dry pipe valves other than the Model DPV-1.

NOTICE

The TYCO Model ACC-1 Dry Pipe Valve Accelerator described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the performance of this device.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

Technical Data

Approvals
UL and ULC Listed
FM Approved
LPCB Approved

Maximum Working Water Pressure
250 psi (17,2 bar)

Maximum Working Air Pressure
70 psi (4,8 bar)

Pressure Decay For Trip
1 psi/min (0,07 bar/min)

Physical Characteristics
Body components constructed of alodine coated aluminum alloy with austenitic series stainless steel internal components. Seals are EPDM and silicone.

Design Data

The connection to the system piping, see Figure 4, must be located so that drain back water will not flow into the accelerator piping and it must be located at a point above the maximum expected level of the drain back/condensate water.

If the connection is made to the riser, it must be located at least two feet above the level of the dry pipe valve. Connections to a feed or cross main must be made either to the side or top of the main.

NOTICE

Failure to follow the above instructions can result in accidental tripping due to closure of the ball float.

Quick operation of the accelerator does not ensure that the fire protection system will meet the water delivery time requirement of the authority having jurisdiction (following opening of the inspector's test connection). The sprinkler system designer needs to be aware that water delivery time is primarily determined by the configuration and volume of the piping network, system air pressure at time of accelerator trip, and water supply characteristics.

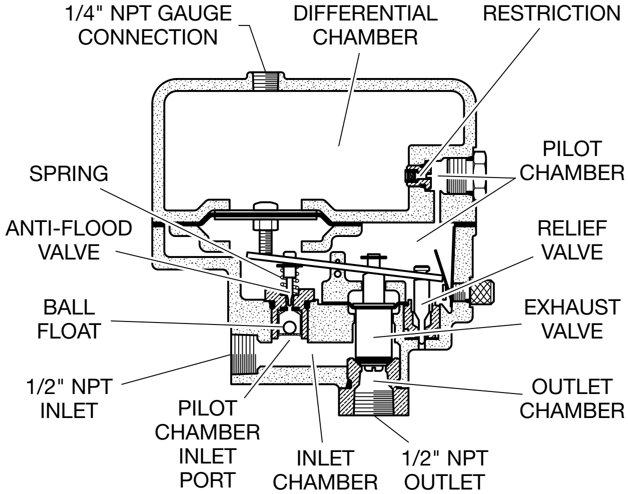


FIGURE 1
MODEL ACC-1 ACCELERATOR
IN SET POSITION

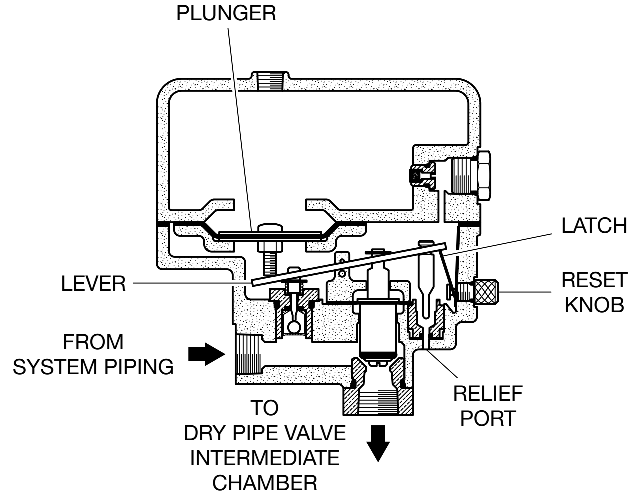


FIGURE 2
MODEL ACC-1 ACCELERATOR
IN TRIPPED POSITION

Operation

The accelerator inlet chamber, see Figure 1, is pressurized via its connection to the system (at a point above the maximum expected level of drain back water). The pilot chamber is, in turn, pressurized through its inlet port which is formed by the annular opening around the lower tip of the anti-flood valve. As the pilot chamber increases in pressure, the differential chamber is pressurized through the restriction.

The accelerator is in its set position while it is being pressurized as well as after the inlet, pilot chamber and differential chamber pressures have equalized. When in the set position, the outlet chamber is sealed off by the exhaust valve which is held against its seat by a combination of the spring pushing up against the lever and the net downward force exerted by the pressure in the pilot chamber.

Both small and slow changes in system pressure are accommodated by flow through the restriction. When, however, there is a rapid and steady drop in system pressure, that is, inlet and pilot chamber, the pressure in the differential chamber reduces at a substantially lower rate. This condition creates a net downward force on the plunger which rotates the lever. As the lever is rotated, see Figure 2, the relief valve is raised out of the relief port and the anti-flood valve is depressed downward into the pilot chamber inlet port, venting the pilot chamber.

The system pressure in the inlet chamber then forces (raises) the exhaust valve off its seat. This continues the rotation of the lever into the tripped (latched) position, see Figure 2. As the exhaust valve is raised off its seat, system pressure is transmitted to the intermediate chamber of the dry pipe valve which neutralizes the differential pressure holding the valve closed.

Following the dry pipe valve trip, major water borne debris is prevented from entering the accelerator by the connection to the system piping and the strainer located at its inlet. Water and any fine water borne debris such as silt is prevented from entering the pilot chamber by virtue of the anti-flood valve having sealed off its inlet port. The check valve located downstream of the accelerator outlet prevents any water borne debris from entering the accelerator by the connection to the intermediate chamber of the dry pipe valve.

After the accelerator/dry pipe valve has tripped and the sprinkler system has been drained, the piping from the system to the accelerator must also be drained and the accelerator reset/inspected according to the instructions given in the Setting Procedure section.

The rate-of-flow through the restriction has been set such that the accelerator provides the maximum practical sensitivity to a loss in system pressure due to a sprinkler operation while still being capable of automatically compensating for normal variations in system pressure such as are caused by environmental temperature changes. A test for verifying that the rate-of-flow through the restriction is within the range for optimum accelerator performance is given in the Setting Procedure section.

NO.	DESCRIPTION	QTY.	P/N
1	Base	1	NR
2	Cover	1	NR
3	Upper Diaphragm Plate	1	See (c)
4	Pivot Plate Assembly	1	See (b)
4a	Spirol Pin	1	
4b	Pivot Plate	1	
5	Plunger	1	See (a)
5a	Pan Hd. Machine Screw	1	
5b	Upper Diaphragm Retaining Ring	2	
5c	Upper Diaphragm	1	
5d	Jam Nut	1	
6	Exhaust Valve	1	See (a)
6a	Upper Plug	1	
6b	Washer	1	
6c	Lower Diaphragm	1	
6d	Lower Plug	1	
6e	O-Ring*	1	
6f	O-Ring Retainer	1	
6g	Exhaust Valve Screw	1	
7	Rd. Head Machine Screw 1/4″-20 UNC x 5/8″	6	See (c)
8	Cover Gasket	1	See (a)
9	Vent Plug	1	See (c)
10	O-Ring*	1	See (a)
11	Restriction	1	See (a)
12	Restriction Access Plug	1	See (c)
13	Pan Hd. Machine Screw 10-32 UNF x 5/8″	4	See (b)
14	Cotter Pin	1	See (b)
15	Lever	1	See (b)
16	Retaining Ring	1	See (b)
17	Anti-Flood Valve	1	See (b)
18	Relief Valve	1	See (b)
19	Spring	1	See (b)
20	Relief Valve Seat	1	See (b)
21	O-Ring*	1	See (b)
22	Seal Washer	1	See (b)
23	Latch	1	See (a)
24	Fillister Hd. Machine Screw 1/4”-20 UNC x 1-1/2″	8	See (c)
25	Plug Seat	1	See (c)
26	O-Ring*	1	See (c)
27	O-Ring*	1	See (a)
28	Reset Knob	1	See (c)
29	Anti-Flood Seat Assembly with Ball Float	1	See (b)
29a	Insert	1	
29b	Seal	1	
29c	Guide	1	
29d	Ball	1	
29e	Clip	1	
29f	O-Ring*	1	

*Requires thin film of FS3452 Fluorosilicone Grease

NR: Not Replaceable

Replacement Part Kits

Kit	Description	P/N
Repair Parts Kit (a)	Includes Items 5, 6, 8, 10, 11, 23, 27 & 1.5 grams of FS3452	92-311-1-116
Replacement Parts Kit (b)	Include Items 4, 13-22, 29 & 1.5 grams of FS3452	92-311-1-117
Replacement Parts Kit (c)	Includes Items 3, 7, 9, 12, 24-26, 28, & 1.5 grams of FS3452	92-311-1-118

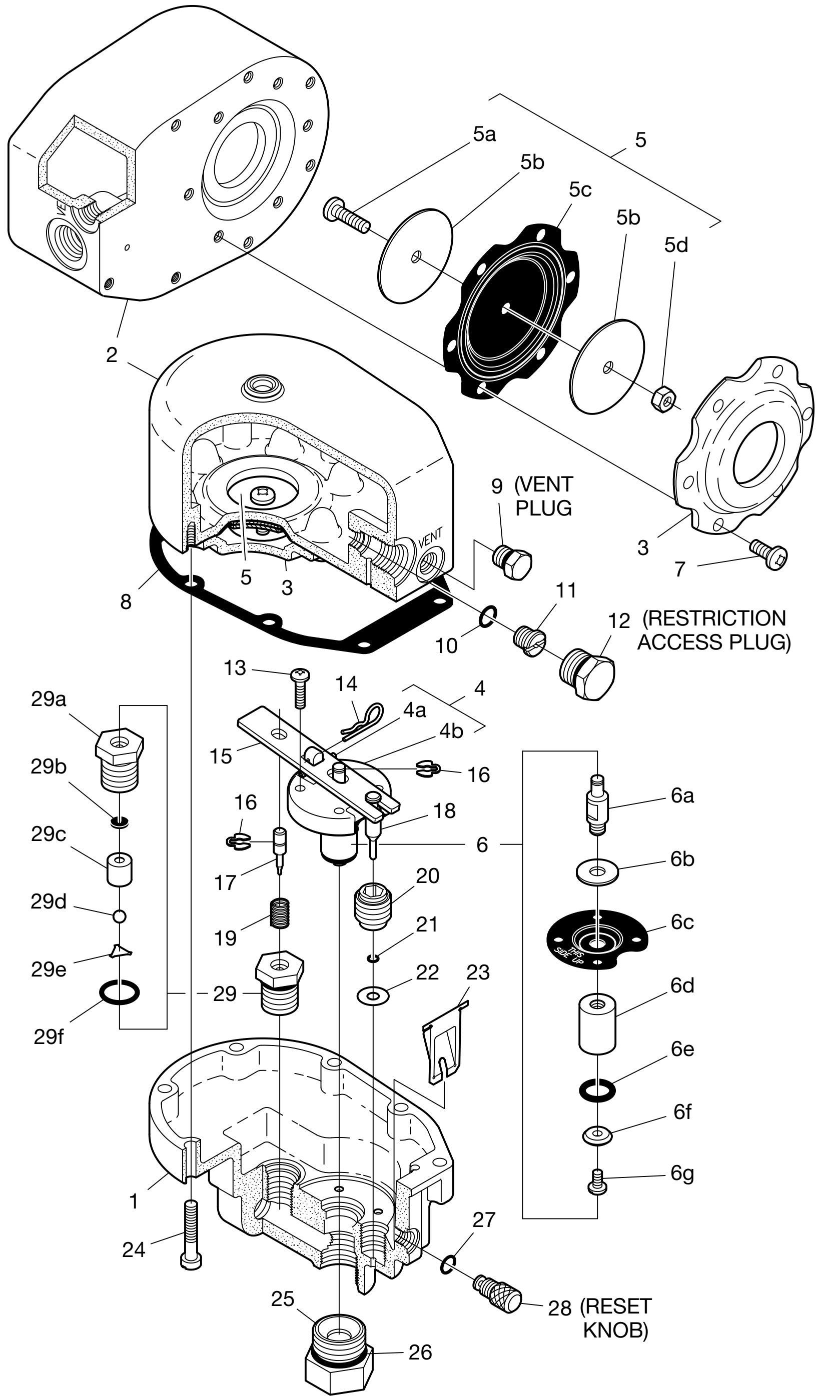
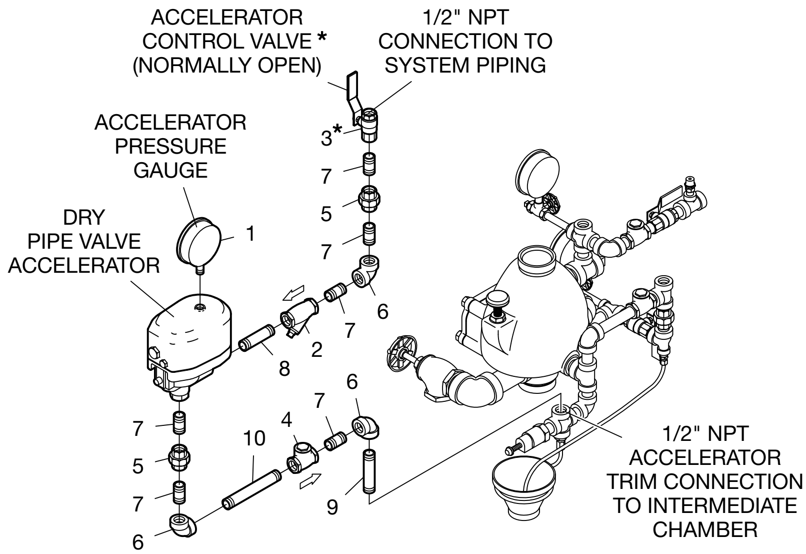


FIGURE 3
MODEL ACC-1 ACCELERATOR ASSEMBLY

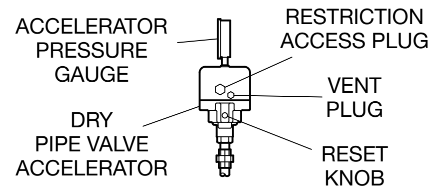
NO.	DESCRIPTION	QTY	P/N
1	250 psi/ 1750 kPa Air Pressure Gauge	1	92-343-1-012
2	1/2" Y-Strainer	1	52-353-1-005
3	1/2" Ball Valve	1	46-050-1-004
4	1/2" Swing Check Valve	1	46-049-1-004
5	1/2" Union	2	CH
6	1/2" 90° Elbow	3	CH
7	1/2" x 1-1/2" Nipple	6	CH
8	1/2" x 3" Nipple	1	CH
9	1/2" x 3-1/2" Nipple	1	CH
10	1/2" x 5-1/2" Nipple	1	CH

CH: Common Hardware

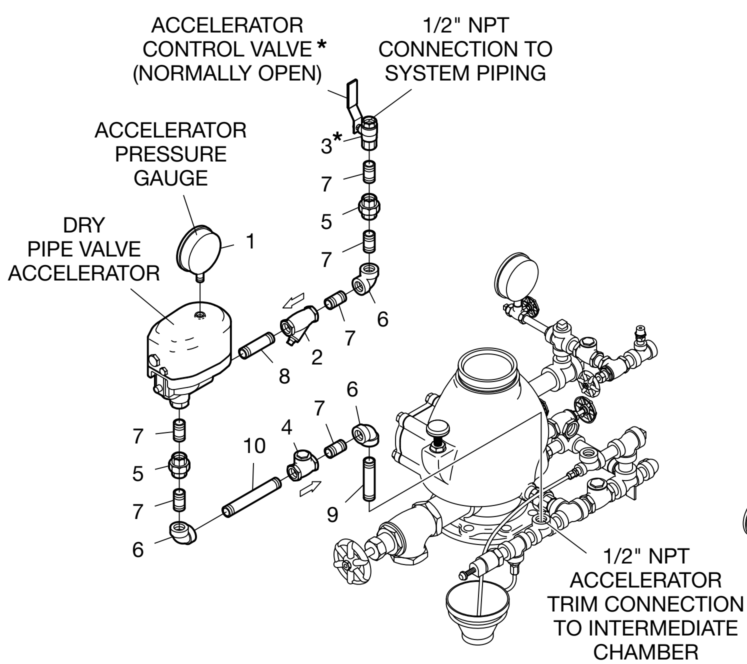
* In accordance with the 2007 edition of NFPA 13, 7.2.4.4, the Accelerator Control Valve shall be supervised. Where a signaling service is to be utilized, replace the Ball Valve with a BVS-1/2" electrically supervised control valve.



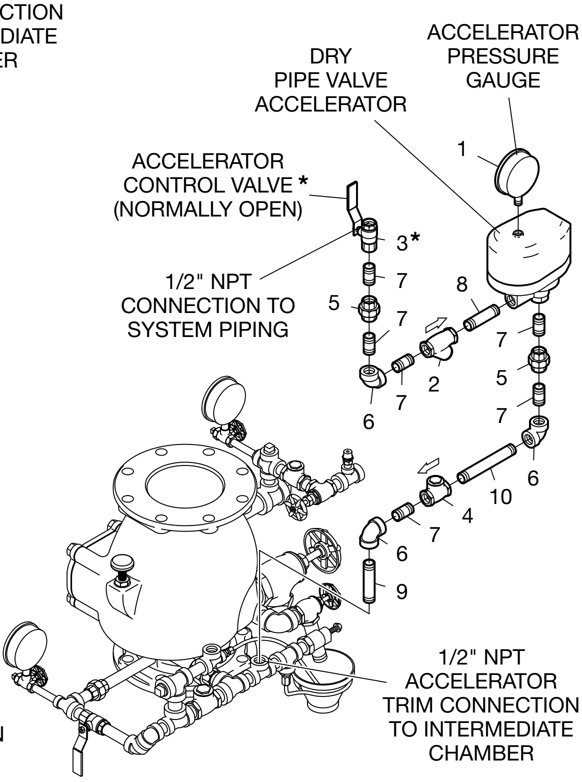
2-1/2 or 3 INCH (DN65 or DN80)



ACCELERATOR NOMENCLATURE



4 INCH (DN100)



6 INCH (DN150)

FIGURE 4
MODEL ACC-1 DRY PIPE VALVE ACCELERATOR TRIM FOR 2-1/2, 3, 4, AND 6 INCH MODEL DPV-1 DRY PIPE VALVES

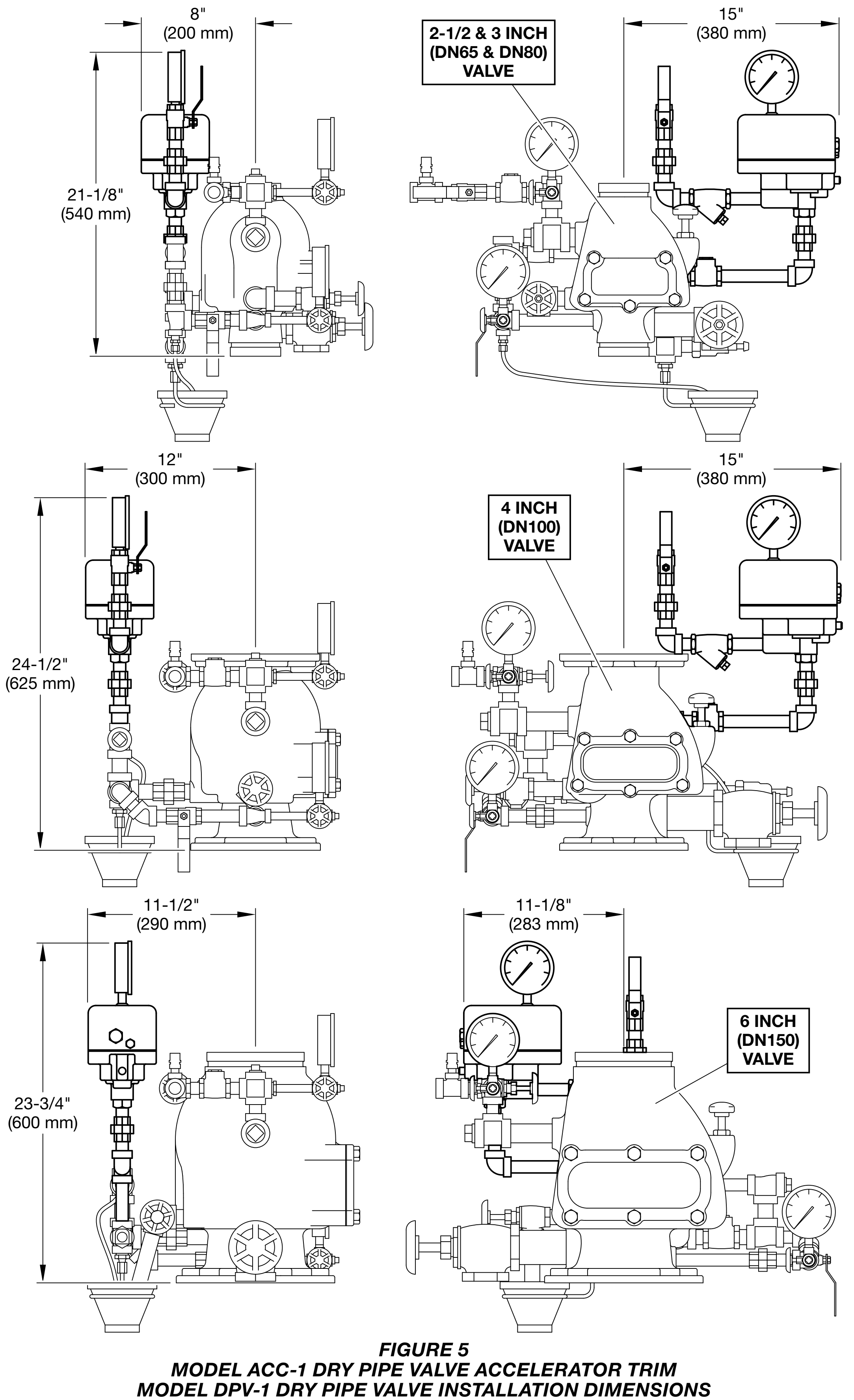


FIGURE 5
MODEL ACC-1 DRY PIPE VALVE ACCELERATOR TRIM
MODEL DPV-1 DRY PIPE VALVE INSTALLATION DIMENSIONS

Installation

The TYCO Model ACC-1 Dry Pipe Valve Accelerator must be installed in accordance with this section.

NOTICE

Failure to follow these instructions can result in flooding of the Accelerator and accidental tripping due to closure of the ball float.

Step 1. The accelerator must be positioned vertically and trimmed per the arrangement shown in Figure 4. Apply pipe thread sealant sparingly to male threads only.

Step 2. The strainer located at the accelerator inlet must be installed with its arrow pointed towards the accelerator.

Step 3. The check valve located in the line between the accelerator outlet and the intermediate chamber of the dry pipe valve must be installed horizontally with its arrow pointed in the direction of flow to the intermediate chamber.

Step 4. The connection to the system piping must be located so that drain back water will not flow into the accelerator piping and it must be located at a point above the maximum expected level of the drain back/condensate water.

If the connection is made to the riser, it must be located at least two feet above the level of the dry pipe valve priming water. Connections to a feed or cross main must be made either to the side or top of the main.

Step 5. The accelerator/dry pipe valve combination must be installed in a heated enclosure which is maintained at a minimum temperature of 40°F/4°C. Heat tracing is not permitted.

Step 6. Close the accelerator control valve until the accelerator is ready to be placed in service.

The accelerator control valve must be closed during hydrostatic testing of the system in order to prevent damage to the ball float. After the system is hydrostatically tested and drained, the accelerator connection to the system must be independently drained through the strainer clean-out plug by first removing the strainer clean-out plug and then opening the accelerator control valve to vent the line.

Setting Procedure

The TYCO Model ACC-1 Dry Pipe Valve Accelerator must be reset and restored to service as soon as possible after an operation. Follow the procedure indicated below.

Step 1. Close the system main control valve, the air supply control valve (to the system) and the accelerator control valve.

Step 2. Open the inspector's test connection and then open the main drain valve as well as all auxiliary (low point) drains.

Step 3. After the system has been drained, close the inspector's test connection and all auxiliary drain valves. Leave the main drain valve open.

Step 4. Set the dry pipe valve in accordance with the instructions given in the appropriate technical data sheet. Restore normal system air pressure. Leave the main control valve closed and the main drain valve open.

Step 5. While holding the plunger of the dry pipe valve's automatic drain valve depressed, partially open the accelerator control valve and allow the water in the accelerator piping to blow out. After water spray stops discharging, close the accelerator control valve and then release the plunger. (This instruction does not apply when the Model ACC-1 Dry Pipe Valve Accelerator is being set for the first time, since the Accelerator is shipped in the set position. Proceed to Step 6.)

Step 6. Clean out the strainer at the accelerator inlet.

NOTE: *A clogged strainer can prevent the accelerator from properly tripping the dry pipe valve.*

Step 7. Slowly remove the vent plug located in the front of the accelerator cover and bleed off any residual air pressure in the differential chamber.

Step 8. Unscrew (counter-clockwise rotation) the knurled reset knob at the front of the accelerator until it resists further turning. A click, which is the sound of the lever snapping back into the set position, may be heard. Screw the reset knob back in until it is finger tight.

NOTE: *Do not wrench on the reset knob, since damage may result. The reset knob will turn with finger torque only.*

Pressure psi	Time Minimum sec.	Time Maximum sec.
20	24	160
25	18	116
32	15	92
40	10	60
50	8	48
60	6	36

TABLE A
DIFFERENTIAL CHAMBER FILL TIMES TO 10 PSI

Step 9. Replace the vent plug.

Step 10. Verify that the system air pressure has returned to normal.

Step 11. Partially open the accelerator control valve just enough to allow air to slowly pass through the accelerator control valve.

Using a watch, note the time for the pressure in the accelerator differential chamber to increase to 10 psi. The time should be within the range of values indicated in Table A for optimum performance of the accelerator.

NOTE: *If the time to pressurize the differential chamber to 10 psi is not within the range of values given in Table A, then the accelerator control valve should be closed and the corrective procedure described in the Care and Maintenance Section followed.*

Step 12. When the air pressure in the accelerator differential chamber is equal to that in the system, then the accelerator is set and ready for service.

Step 13. Close the accelerator control valve and then slowly open the dry pipe valve low body drain valve to bleed off any excess water above the priming level. Close the dry pipe valve low body drain valve, return system pressure to its normal value, and then completely open the accelerator control valve.

Step 14. Partially open the main control valve. Close the main drain valve as soon as water discharges from the drain connection, and then completely open the main control valve. The fire protection system is now ready for service.

NOTE: *After placing a fire protection system in service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.*

Care and Maintenance

The following procedures and inspections should be performed as indicated, in addition to any specific requirements of the NFPA, and any impairment must be immediately corrected.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

The TYCO Model ACC-1 Dry Pipe Valve Accelerator must be maintained and serviced in accordance with this section:

Before closing a fire protection system main control valve for inspection or maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

If an accelerator is to be temporarily taken out of service, then the proper authorities and all personnel who may be affected must be notified.

Before performing an alarm test, notify the proper authorities and all personnel who may be affected.

Accelerator Inspection Procedure
It is recommended that the following accelerator inspection procedure be performed quarterly.

Step 1. Verify that the reset knob is screwed in.

Step 2. Close the system main control valve and open the main drain valve to relieve the supply pressure to the dry pipe valve.

Step 3. Verify that the accelerator control valve is open.

Step 4. Open the inspector's test connection. Verify that the time to accelerator trip is essentially the same as in previous tests. A momentary burst of air from the automatic drain valve indicates that the accelerator has tripped.

NOTE: *As the system pressure is decreasing, check for any sign of water being discharged from the accelerator relief port.*

Step 5. Depress the plunger of the automatic drain valve. A steady stream of exhausting air indicates that the accelerator has properly latched in the tripped position.

Step 6. Close the accelerator control valve and the inspector's test connection.

Step 7. Clean out the strainer at the accelerator inlet.

NOTE: *A clogged strainer can prevent the accelerator from properly tripping the dry pipe valve.*

Step 8. Reset the accelerator in accordance with Steps 7 through 14 of the Setting Procedure section.

System Inspection Procedure
It is recommended that the following accelerator and dry pipe valve inspection procedure be performed at least annually, preferably in the spring or summer of the year. This procedure can only be used whenever there is no danger that flooding the system will expose the water to freezing conditions.

Step 1. Verify that the reset knob is screwed in.

Step 2. Open the inspector's test connection. Verify that tripping of the accelerator operates the dry pipe valve and that water is delivered out of the inspector's test connection within the elapsed time required by the authority having jurisdiction.

NOTE: *As the system pressure is decreasing, check for any sign of water being discharged from the accelerator relief port.*

Step 3. Reset the accelerator and dry pipe valve in accordance with the Setting Procedure section

Trouble-Shooting

Refer to the following subsections, as applicable. If the designated instructions do not remedy the particular problem, refer to the Accelerator Disassembly and Reassembly subsection.

Water Discharge From Accelerator Relief Port
Use the following instructions if water is discharged from the accelerator relief port during a trip.

Step 1. Verify that the connection from the accelerator to the system piping is installed in accordance with Step 4 of the Installation section. Correct if necessary.

Step 2. Investigate for and correct any condition which could result in an excessive build-up of drain back and/or condensate water.

Step 3. Review procedures which were used to set the accelerator. Failure to perform Step 5 of the Setting Procedure can permit a small amount of water to enter the accelerator pilot chamber.

Slow Fill of Differential Chamber
Use the following instructions if the time to fill the differential chamber is longer than the maximum value indicated in Step 11 of the Setting Procedure section.

Step 1. Check to see that the accelerator was reset per Step 8 of the Setting Procedure section.

Step 2. Close the system main control valve and open the main drain valve.

Step 3. Check for any sign of external leakage past the accelerator pressure gauge, vent, and restriction access plug connections.

Step 4. Check for any sign of external leakage past the reset knob and cover gasket.

Step 5. Close the accelerator control valve.

Step 6. Gently insert a 3/32 inch or smaller diameter probe into the relief port. If the probe can be inserted more than 1/4 inch then the lever has not reset and the accelerator must be disassembled for internal inspection. See the instructions for Accelerator Disassembly and Reassembly.

Step 7. Slowly remove the accelerator vent plug to bleed all pressure from the differential chamber and then slowly remove the restriction access plug to bleed all pressure from the pilot chamber.

Step 8. Replace the restriction and then the restriction access plug.

Step 9. Place the fire protection system back in service in accordance with Steps 9 through 14 of the Setting Procedure section.

Unexplained Accelerator Trip
Use the following instructions if there is an unexplained accidental trip of the accelerator.

Step 1. Verify that the connection from the accelerator to the system piping is installed in accordance with Step 4 of the Installation section. Correct if necessary.

Step 2. Verify the time to fill the differential chamber as described in Step 11 of the Setting Procedure section. If the time to fill the differential chamber to 10 psi is longer than the maximum indicated value, then follow the instructions given under “Slow Fill of Differential Chamber”.

Step 3. If the time to fill the differential chamber is within the indicated range of values, then investigate for and correct any condition which could result in excessive leakage of system air pressure.

Fast Fill of Differential Chamber or Long Time to Accelerator Trip

Use the following instructions if the time to fill the differential chamber is shorter than the minimum value indicated in Step 11 of the Setting Procedure section. This procedure should also be followed if the time to accelerator trip, following opening of the inspector’s test connection, is significantly longer than expected.

Step 1. Close the system main control valve and open the main drain valve.

Step 2. Close the accelerator control valve.

Step 3. Slowly remove the accelerator vent plug to bleed all pressure from the differential chamber and then slowly remove the restriction access plug to bleed all pressure from the pilot chamber.

Step 4. Using a slotted screw driver, check the tightness of the restriction.

Step 5. Inspect the restriction o-ring seal. The o-ring must be replaced if there are any signs of nicks, cuts, or deterioration due to age. Replace the restriction after cleaning and lubricating its o-ring with a non-petroleum based grease, such as Dow Corning FS3452. Replace the vent plug and restriction access plug.

Step 6. If the restriction and its o-ring are found to be in good condition, then it is likely that there is leakage past the plunger. Remove the cover from the base. Check that the six screws securing the upper diaphragm plate to the cover are tight.

Inspect the upper diaphragm for any sign of cracks, pin holes or deterioration due to age. Replace the plunger if there is any possibility of leakage past the upper diaphragm.

Step 7. Reassemble the accelerator and place the fire protection system back in service in accordance with Steps 10 through 14 of the Setting Procedure section.

Air Leakage Out Automatic Drain

If there is leakage of air out the dry pipe valve automatic drain, after the accelerator and dry pipe valve have been placed in service, then it will be necessary to first determine whether the leakage is past the accelerator or the dry pipe valve.

Close the accelerator control valve. Slowly remove the accelerator vent plug to bleed all pressure from the differential chamber and then slowly remove the restriction access plug to bleed all pressure from the pilot chamber.

If leakage out the automatic drain persists then refer to the dry pipe valve Technical Data Sheet for maintenance instructions. If leakage out of the automatic drain stops, then the accelerator will have to be taken out of service and the accelerator plug seat removed for cleaning of the seat and the lower o-ring area on the exhaust valve.

Accelerator Disassembly and Reassembly (For Internal Inspection As Necessary)

Step 1. Close the system main control valve and open the main drain valve.

Step 2. Close the accelerator control valve.

Step 3. Slowly remove the accelerator vent plug to bleed all pressure from the differential chamber and then slowly remove the restriction access plug to bleed all pressure from the pilot chamber.

Step 4. Break the union connections at the accelerator inlet and outlet and remove it from the line. Plug the connection to the intermediate chamber of the dry pipe valve and place the fire protection system in service while the accelerator is out for maintenance.

Step 5. Remove the eight screws holding the cover to the base and remove the cover.

Step 6. Remove the six screws holding the upper diaphragm plate to the cover. Remove the plunger and inspect the upper diaphragm to be sure that it is flexible and free from physical damage or deterioration due to age.

Check the jam nut to assure that it is assembled tightly to its screw. Re-mount the plunger and upper diaphragm plate, taking care to cross-tighten the screws uniformly.

Step 7. Replace the restriction, see Figure 3, Item 11, if it has been wetted or clogged. Clean and lubricate the restriction o-ring seal with a fine film of non-petroleum based grease, such as Dow Corning FS3452.

Replace the following parts:

- Vent Plug, see Figure 3, Item 9
- Restriction Access Plug, see Figure 3, Item 12

***NOTE:** Do not lubricate the restriction access plug, or leave an already lubricated restriction access plug in place. The restriction access plug must be replaced.*

Step 8. Remove the retaining ring from the upper plug portion of the exhaust valve. Remove the four screws holding the pivot plate. Remove the subassembly of the lever and pivot plate, the exhaust valve, the anti-flood valve and the relief valve.

Step 9. Inspect the lower diaphragm to be sure that it is flexible and free from physical damage or deterioration due to age.

Step 10. Check to see that the exhaust valve components are securely assembled together. Only tighten by gripping the flats using an open end type wrench.

Step 11. Inspect the o-ring on the lower plug. It must be replaced if there are any signs of nicks, cuts or deterioration.

Step 12. Inspect the relief and anti-flood valves. If either is bent or nicked it must be replaced.

Step 13. Remove and inspect the latch. The catch leaf should extend 5/16 to 3/8 inches in the free state.

Step 14. Remove the relief valve seat. Remove the o-ring and seal washer. Carefully clean the o-ring and seal washer seating surfaces in the valve seat and accelerator base. If the o-ring or seal washer is nicked, cut, or shows signs of deterioration, it must be replaced.

Step 15. Replace the seal washer in the accelerator base. Apply a thin film of Dow Corning FS3452 Fluorosilicone Grease to the valve seat. Place the o-ring in its seat, the lubricant will hold it in place, and then thread the relief valve seat into the body with 10 to 15 ft-lbs of torque.

Step 16. Remove the anti-flood seat assembly with ball float. Check for damaged parts and for freedom of ball movement. If parts are damaged or inoperative, the assembly must be replaced.

Step 17. After checking the anti-flood seat assembly with ball float, lubricate the o-ring with a thin film of Dow Corning FS3452 Fluorosilicone Grease, and thread the assembly into the body with 10 to 15 ft-lbs of torque.

Step 18. Remove the reset knob. Carefully clean the o-ring and its seating surface. If the o-ring is cut, nicked, or shows signs of deterioration it must be replaced. Lubricate the o-ring with a thin film of Dow Corning FS3452 Fluorosilicone Grease.

Step 19. Reassemble the accelerator in the following order.

- **a.** Thread the reset knob into the base finger tight.
- **b.** Set the anti-flood valve (with retaining ring in place) and the compression spring into their seat.
- **c.** Set the exhaust valve in place.
- **d.** Slide the relief valve into the slot at the end of the lever and then remount the sub-assembly of the lever and pivot plate in the base, taking care to cross-tighten the screws uniformly.
- **e.** Replace the retaining ring on the upper plug.
- **f.** Push the anti-flood valve end of the lever down and release it twice to assure that there is no binding.
- **g.** Replace the latch making sure that the notch in the bottom straddles the reset knob and that the tabs at the top are seated in the base. Place the lever in the tripped (latched) position.
- **h.** Place the cover upside down. Set the cover gasket in place and then push all eight screws through the gasket to assist in assembling the cover to the base.
- **i.** Align the cover with the base and tighten all of the screws uniformly.
- **j.** Replace the vent plug and the restriction access plug.
- **k.** Reinstall the accelerator and return the system to service in accordance with the Setting Procedure section.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Orders for the TYCO Model ACC-1 Dry Pipe Valve Accelerator, trim and replacement parts must include the description and Part Number (P/N). The Complete Model ACC-1 Accelerator Package includes the Accelerator and Basic Galvanized Trim.

Complete Package
Specify: Complete TYCO Model ACC-1 Dry Pipe Valve Accelerator Package, P/N 52-311-2-002

Accelerator Only
Specify: Model ACC-1 Dry Pipe Valve Accelerator, P/N (specify):

EMEA 52-311-1-001
Americas/APAC 52-311-1-001P

Basic Galvanized Trim Only
Specify: Model ACC-1 Dry Pipe Valve Accelerator, Basic Galvanized Trim for 2-1/2 thru 6 inch Model DPV-1 Dry Pipe Valves, P/N 52-311-2-010

Replacement Parts for Accelerator
(Specify description) for use with Model ACC-1 Dry Pipe Valve Accelerator, P/N (see Figure 3)

Replacement Trim Parts
Specify: (specify description), P/N (see Figure 4)

1467 Elmwood Avenue, Cranston, RI 02910 | Telephone +1-401-781-8220

C-AIRE® COMPRESSORS

SERVICE • QUALITY • INNOVATION

S715

WHISPER QUIET SERIES

PRODUCT NUMBERING SYSTEM

S715H - LD1 - 230

MOUNTING OPTIONS	PHASE	VOLTAGE	ADDITIONAL OPTIONS
H: Horizontal Tank	**1:** Single Phase	230 (208/230V)	**P:** Prewired Power Cord **Z:** Zero Loss Tank Drain

- ✓ Oil-free and low maintenance
- ✓ Appropriate for single or multiple-valve systems
- ✓ Quiet
- ✓ Add a new automatic air maintenance device from C-Aire
- ✓ 1-year warranty
- ✓ Low vibration
- ✓ 5-minute installation
- ✓ CAD & Revit files available

SYSTEM SIZE	PSI	GAL.
PRE-ACTION	10	3322
LOW PRESSURE	18	1845
STANDARD PRESSURE	40	830

IDEAL FOR QUIET SETTINGS

NURSING HOMES | CHURCHES | APARTMENT BUILDINGS

TECHNICAL SPECIFICATIONS

HORSEPOWER	3
PRESSURE SWITCH	On @ 50 PSI, Off @ 100 PSI
CFM	10.07 @ 10 PSI
PUMP	2 Cylinder, Oil-Free (3)
TANK SIZE	30 Gallon Horizontal
NOISE LEVEL	68 dBA
OUTLET	1/2” NPT
DIMENSIONS (LxDxH)	40” x 18” x 38”
SHIPPING WEIGHT	305 lbs.

ELECTRICAL SPECIFICATIONS

PHASE/ VOLTS	FULL LOAD AMPS	BREAKER SIZE (A)	WIRE SIZE (AWG)		
			25’	50’	75’
1/230	11.7	20	12	10	8

ACCESSORIES AVAILABLE

Automatic Air Maintenance Device
Part: CAMD1
Pack of 16: CAMD1-16PK

Installation Kit
Part: 100-FIRE

1/2" x 30" stainless steel flexible hose
Part: DT 3005 H-1PK
Pack of 5: PART DT 3005 H-5PK

1/2" x 36" flexible hose
Part: DT 3605 H
Pack of 5: PART DT 3605 H-5PK

1/2" x 48" flexible hose
Part: DT 4805 H
Pack of 5: PART DT 4805 H-5PK

Zero Loss Tank Drain Kit
Part: ZLOSS-K

S715.0

Air Maintenance Device

For Dry Pipe Sprinkler Systems,
Air Supervised Pre-Action Systems,
& Dry Pilot Actuated Deluge Systems

UL Listed and FM Approved

Manufactured by: General Air Products, Inc.
118 Summit Drive, Exton, PA 19341

Call

1-800-345-8207

for assistance

or visit our website for information on these and all of our products

www.GENERALAIRPRODUCTS.com

Product Description

The enclosed Automatic Air Maintenance Device is a UL Listed and FM Approved assembly of valves, nipples, fittings, and actuators to automatically control the air pressure in the piping of dry pipe sprinkler systems, preaction sprinkler systems, or dry pilot actuated deluge systems.

The Air Maintenance Device is designed to automatically feed air into the system piping at the required volume and pressure from an air source such as:

1. An air compressor
2. An air receiver tank
3. A plant air system (owner's air)

When an air receiver tank or plant air is utilized as the air supply source, the pressure regulator in the Air Maintenance Device AMD-1 and AMD-1ALT automatically regulates the air pressure to the designated level. The outlet pressure of the regulator is field adjustable.

When an electrically-driven air compressor is utilized as the air supply source, the pressure switch in the Air Maintenance Device AMD-2, AMD-2ALT and AMD-3 automatically causes the air compressor to cut-in or cut-out at the minimum and maximum air pressures desired, respectively. The cut-in and cut-out pressures are field adjustable.

The automatic air supply is directed through a restricted orifice in the air maintenance device so that upon activation of a sprinkler, the air supply will not interfere with the operation of the dry pipe valve, by continuing to supply high volumes of pressurized air to the piping system.

It is a recommended safeguard that a low pressure switch and alarm be installed on dry pipe systems or other air supervised piping systems. This will cause an alarm to sound if the pressure falls below a predetermined level.

Operation

The Air Maintenance Device provides a continuous but restricted air supply to the piping system.

The activation of only one sprinkler in a dry pipe system, will cause the system pressure to diminish to the point where the dry pipe valve will “trip”, thereby filling the system piping with water.

Small piping system air leaks will be compensated for by the automatic air feed provided the air leaks do not exceed the restricted air supply.

Technical Data

Model: AMD-1, AMD-1ALT; AMD-2, AMD-2ALT; AMD-3
Style: With Air Regulator (AMD-1, AMD-1ALT)
With Air Pressure Switch (AMD-2, AMD-2ALT, AMD3)
Approvals: UL, FM
Factory Operation Test:
100% at 35 psi air (AMD-1, AMD-1ALT)
100% at 30 & 40 psi air (AMD-2, AMD-2ALT, AMD-3)

Ordering Information

Mfgr. Source: General Air Products, Inc.
Weight: 7 lbs. (AMD-1, AMD-1ALT)
11 lbs. (AMD-2, AMD-2ALT, AMD-3)
When placing an order, indicate the full product name. Please specify the quantity, model and style.

Guarantee

General Air Products, Inc. will repair and/or replace any products found to be defective in material or workmanship within a period of one year from the date of shipment. Please refer to the current price list for further details of the warranty.

Design Data

An Air Maintenance Device should be permanently connected to all dry pipe sprinkler systems to avoid the possibility of false valve “trips” which may result from small piping leaks gradually lowering system air pressure.

An Air Maintenance Device may also be utilized to automatically control the air supply to the piping system of an air supervised preaction system or to the pilot lines of a dry pilot actuated deluge valve.

There are several methods of providing a constant and controlled supply of air to a sprinkler system as follows:

Air Compressor and Air Maintenance Device Model (AMD-2)

The air compressor is connected electrically and mechanically to the trim of the dry pipe valve, through an Air Maintenance Device equipped with a pressure switch. The air pressure switch continuously senses the air pressure in the piping system and turns the compressor on if the pressure drops below the cut-in setting and turns the compressor off if the pressure rises above the cut-out setting. The cut-in pressure is usually set at the design air pressure for maintaining the dry pipe valve in the closed position. The cut-out pressure should be set approximately 10 psi above the cut-in pressure.

Note: If the dry pipe valve is equipped with an accelerator, this method of air maintenance is not recommended. The accelerator is sensitive to a 3 to 5 psi air pressure drop at a rate of approximately 1 psi in 10 seconds - see AMD-1.

Air Compressor with Air Receiver Tank and Air Maintenance Device (Model AMD-1)

The compressor-tank unit is equipped with an integral pressure switch that controls the pressure in the tank, maintaining the tank pressure at a level 10 to 15 psi above the designed air pressure demand of any dry pipe system supplied by the air compressor tank unit. The compressor-tank unit is mechanically connected to the trim of the dry pipe valve, through an Air Maintenance Device equipped with an air pressure regulator. The pressure regulator continuously regulates the incoming air (from the air receiver tank) and maintains the outgoing air pressure at the pressure setting of the regulator, usually within an accuracy of 1 psi. The outgoing air pressure setting is field adjustable from 5 to 75 psi. If the dry pipe valve is equipped with an accelerator, this method of air-maintenance is recommended.

AMD-1 Includes Non-Listed Pressure Gauge

The AMD-1 includes a non-listed pressure gauge for use with the regulator. Gauge ships uninstalled. To install, remove the 1/8” plug on the regulator and install the pressure gauge into the open port.

Plant Air Supply and Air Maintenance Device (AMD-1)

The plant air supply is mechanically connected to the trim of the dry pipe valve through an Air Maintenance Device equipped with an air pressure regulator. The pressure regulator continuously regulates the incoming air and maintains the outgoing air pressure at the pressure setting of the regulator, usually within and accuracy of 1 psi. The outgoing air pressure setting is field adjustable from 5 to 75 psi. The minimum pressure in the plant air supply must be greater than the design air pressure required by the dry pipe system since the air pressure regulator will only regulate pressure downward.

Installation

General

The Air Maintenance Device must be installed in the air supply line leading to the dry pipe valve trim, preaction system piping or dry pilot system piping. The air flow through the Device must be in the direction shown by the arrows on the units.

Note: The minimum pipe size is 1/2” diameter.

Note: In particularly humid environments, a manual desiccant air dryer (P/N AD3400) should be properly installed between the compressor and the dry pipe valve to remove moisture from the compressed air supply. Condensed moisture that is allowed to back up into the compressor cylinder may cause compressor damage. Cold room / freezer room installations must have a pre-packaged *Dry Air Pac* ™ which includes an AMD-1. Consult factory for correct installation procedures.

Model AMD-1 (Pressure Regulator) (see Fig. 1)

Step 1. Close the 1/4” ball valves (#8) and open the bypass valve (#7) in the Air Maintenance Device and open the air supply valve in the dry pipe valve trim.

Step 2. Open the air supply control valve from the plant air system or air receiver tank to pressurize the system.

Step 3. When the system is pressurized, check the air pressure gauge to verify the the pressure is at the design pressure requirement for the system.

(Continued)

UL Listed and FM Approved

GENERAL AIR PRODUCTS

Manufactured by: General Air Products, Inc.
118 Summit Drive, Exton, PA 19341

Installation (continued)

Model AMD-1 (Pressure Regulator)

Caution: Care must be taken NOT to overpressure the system above the regulator setting when using the quick fill line.

Note: If necessary, to adjust the system pressure ensure the pressure gauge is installed in the regulator port. Pull the adjustment knob away from the body of the regulator and then turn it IN to increase the system pressure and OUT to reduce system pressure (see Fig. 1).

When reducing from a higher to a lower setting, first reduce to some pressure less than desired, then bring up to the desired point.

After achieving the desired pressure setting, lock the pressure setting by pushing the adjustment knob in towards the body of the regulator.

Step 4. Close the bypass valve (#7) and open the two 1/4" ball valves (#8). The Air Maintenance Device is now in service.

Model AMD-2 (Pressure Switch) (see Fig. 2)

Step 1. An electrical power circuit should be installed using the pressure switch to control the compressor motor in accordance with the National Electric Code and/or the requirements of the local Authority Having Jurisdiction. Consult factory for specific recommendations.

Step 2. Close the 1/4" ball valves (#18) and open the bypass valve (#17) in the Air Maintenance Device and open the air supply valve in the dry pipe valve trim.

Step 3. Energize the branch circuit to the pressure switch to start the compressor and pressurize the system.

Step 4. When the system is pressurized, the pressure switch will cut-out and stop the compressor. Note the cut-out pressure.

Step 5. Open any valve connected to the piping system (such as the three-way valve for the air gauge on the dry pipe valve trim) just enough to slowly reduce the air pressure. Close it immediately when the pressure switch cuts-in and note the cut-in pressure. Verify the the cut-in and cut out pressures meet the minimum design requirements for the system air pressures.

Note: If necessary, adjust the cut-in or the cut-out pressure. Loosen the hex-nut on the cover of the pressure switch and remove the cover. Adjust the cut-in pressure by turning the Pressure Adjustment Screw in the proper direction. Adjust the pressure differential (difference between cut-in and cut-out pressure) by turning the Pressure Differential Screw. Consult Factory if in any doubt.

Step 6. Close the bypass valve (#17) and open the two 1/4" ball valves (#18). The Air Maintenance Device is now in service.

Care and Maintenance

The Air Maintenance Device does not require any regularly scheduled maintenance. However, it is recommended that proper operation and condition be periodically verified as follows:

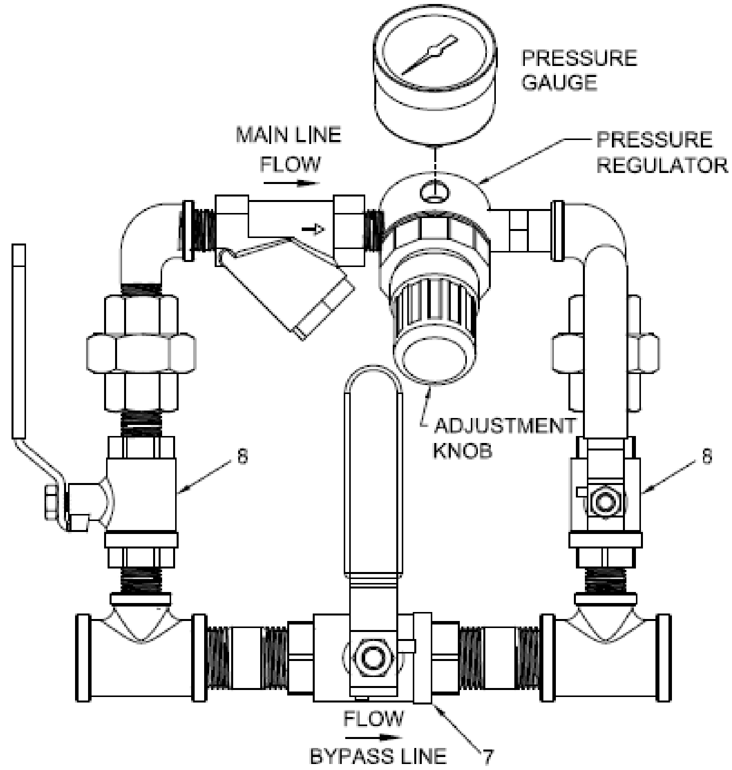
1. Verify that the 1/2" bypass valve is closed, the two 1/4" ball valves are open, and the air supply control valve in the dry pipe valve trim is open.

2. Verify that the cut-in and cut-out pressures are at the proper setting, if applicable.

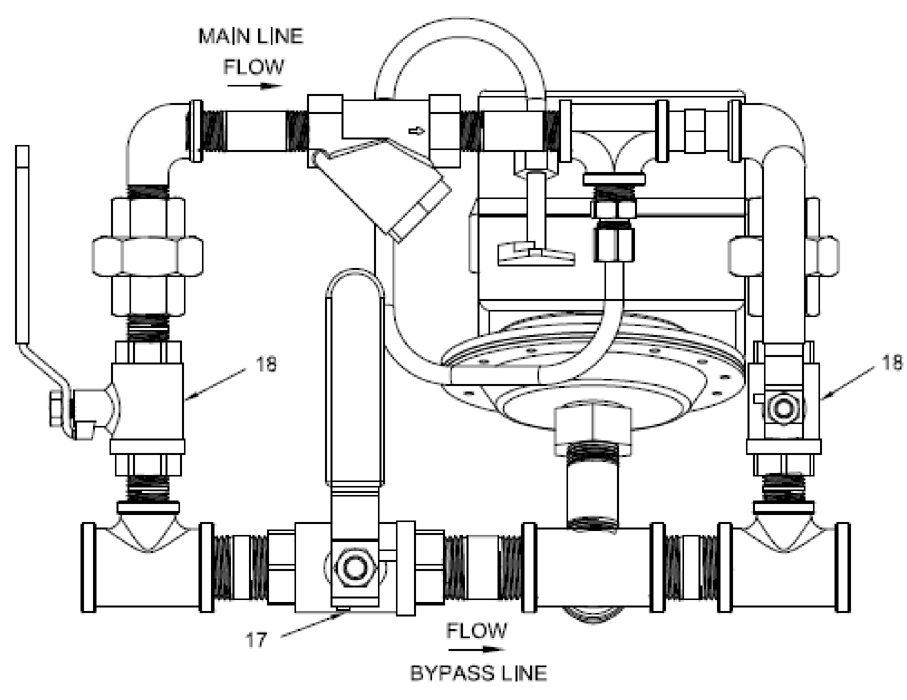
3. Verify that the regulated pressure is at the proper setting, if applicable.

4. Accumulated moisture should be removed from the drip leg on the air supply line and the desiccant in the air dryer should be replaced, if applicable.

5. The strainer should be cleaned.



AMD1
FIGURE 1



AMD2
FIGURE 2

SECTION 5

Alarms & Supervisory Devices

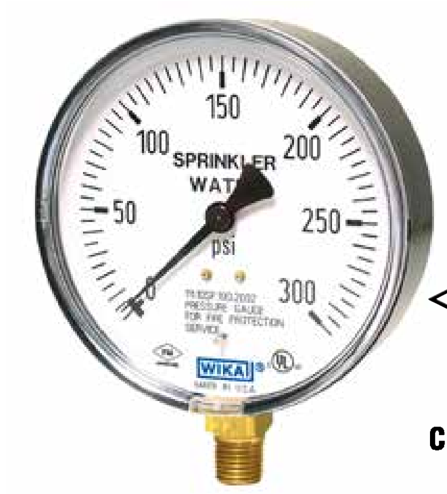
Bourdon Tube Pressure Gauges
Standard Series
Type 111.10SP

Applications

- Fire sprinkler systems
- Suitable for all media that will not obstruct the pressure system or attack copper alloy parts

Product Features

- UL-listed (UL-393), United States and Canada
- Factory Mutual (FM) approved
- Reliable and economical



FM APPROVED

C UL US LISTED

Bourdon Tube Pressure Gauge Type 111.10SP

Specifications

Design
EN 837-1 & ASME B40.100

Sizes
4" (100 mm)

Accuracy class
± 3/2/3% of span (ASME B40.100 Grade B)

Ranges
0/80 psi (5,5 bar), retard to 250 psi (17 bar), air
0/300 psi (20 bar), water
0/400 psi (28 bar), water
0/600 psi (40 bar), water

Working pressure
Steady: 3/4 of full scale value
Fluctuating: 2/3 of full scale value
Short time: full scale value

Operating temperature
Ambient: -40°F to 140°F (-40°C to 60°C)
Media: 140°F (+60°C) maximum

Temperature error
Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% of span for every 18°F (10°K) rising or falling.

Bourdon tube
Material: copper alloy
C-shape

Pressure connection
Material: copper alloy
1/4" NPT lower mount (LM)

Movement
Copper alloy

Dial
White aluminum with stop pin; black and red lettering

Pointer
Black aluminum

Case
Black polycarbonate

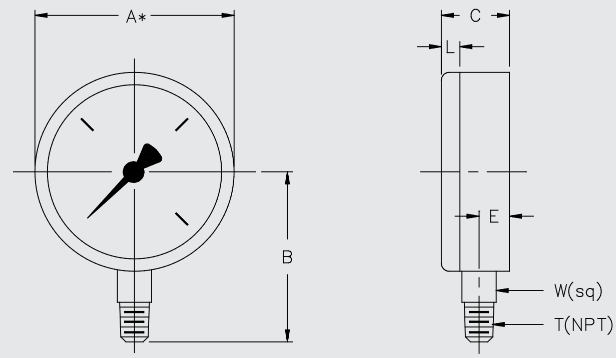
Window
Snap-in clear polycarbonate

Approvals
UL listed (UL-393)
Factory Mutual

Optional Extras
(not all options are UL or FM approved)

- Brass restrictor
- Black-painted steel case
- Custom dial layout
- Other dual scales in combination with psi are available: bar, kPa, MPa, kg/cm²

Dimensions



Size		A	B	C	E	L	T	W	Weight
4”	mm	100	71	30	11.5	3.75		14	
	in	4.0	2.79	1.18	0.45	0.15	1/4”	0.55	0.35 lb.

Ordering information
Pressure gauge model / Nominal size / Scale range / Size of connection / Optional extras required
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.
Modifications may take place and materials specified may be replaced by others without prior notice.

WIKA Instrument Corporation
1000 Wiegand Boulevard
Lawrenceville, GA 30043-5868
Tel: 888-WIKA-USA • 770-513-8200
Fax: 770-338-5118
E-Mail: info@wika.com
www.wika.com

POTTER
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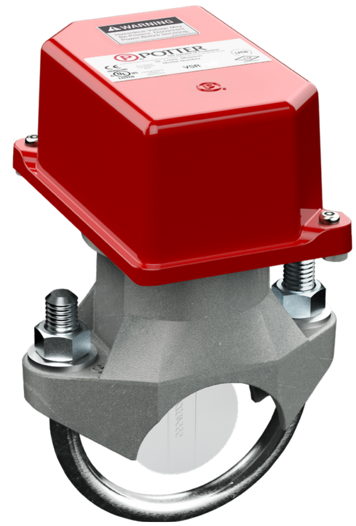
VSR

Vane Type Waterflow Alarm Switch W/ Retard

Features

- Assembled in USA
- 0-90 second field replaceable time delay retard
- Easy to read retard time delay adjustment knob
- UL Listed models for 2"-6" steel pipe schedules 5 through 40
- UL Listed and FM approved models for 2"-8" steel pipe schedules 10 through 40
- Two SPDT (form C) contacts
- Weatherproof
- Easy to read wire terminal designations



⚠WARNING

- Installation must be performed by qualified personnel and in accordance with all national and local codes and ordinances.
- Shock hazard. Disconnect power source before servicing. Serious injury or death could result.
- Risk of explosion. Not for use in hazardous locations. Serious injury or death could result.

CAUTION

Waterflow switches that are monitoring wet pipe sprinkler systems shall not be used as the sole initiating device to discharge AFFF, deluge, or chemical suppression systems. Waterflow switches used for this application may result in unintended discharges caused by surges, trapped air, or short retard times.

CE LPCB LOSS PREVENTION CERTIFICATION BOARD FM APPROVED SIGNALING c UL us LISTED

Description

The Model VSR is a vane type waterflow switch for use on wet sprinkler systems. It is UL Listed for use on a steel pipe; schedules 5 through 40, sizes 2" - 6" and is UL Listed and FM Approved for use on steel pipe; schedules 10 through 40, sizes 2" thru 8" (50 mm thru 200 mm). LPC approved sizes are 2" thru 8" (50 mm thru 200 mm). See Ordering Information chart.

The VSR may also be used as a sectional waterflow detector on large systems. The VSR contains two single pole, double throw, snap action switches and an adjustable, instantly recycling pneumatic retard. The switches are actuated when a flow of 10 GPM (38 LPM) or more occurs downstream of the device. The flow condition must exist for a period of time necessary to overcome the selected retard period.

Enclosure

The VSR switches and retard device are enclosed in a weather/UV/flame resistant high impact composite plastic. The cover is held in place with two tamper resistant screws which require a special key for removal. A field installable cover tamper switch is available as an option which may be used to indicate unauthorized removal of the cover. See bulletin number 5401103 for installation instructions of this switch.

NOTICE

This document contains important information on the installation and operation of the VSR. Please read all instructions carefully and notify the building owner or their authorized representative before any work is done on the fire sprinkler or fire alarm system. A copy of this document is required by NFPA 72 to be maintained on site.

Technical Specifications

Conduit Entrances	Two knockouts provided for 1/2" conduit. Individual switch compartments suitable for dissimilar voltages
Contact Ratings	Two sets of SPDT (Form C) 10.0 Amps at 125/250VAC 2.0 Amps at 30VDC Resistive 10 mAmps min. at 24VDC
Enclosure	Cover - Weather/UV/Flame Resistant High Impact Composite Base - Die-cast aluminum
Environmental Specifications	NEMA 4/IP54 Rated Enclosure suitable for indoor or outdoor use with factory installed gasket when used with appropriate conduit fitting. Temperature Range: 40°F - 120°F, (4.5°C - 49°C) - UL Non-corrosive sleeve factory installed in saddle.
Flow Sensitivity Range for Signal	4-10 GPM (15-38 LPM) - UL
Maximum Surge	18 FPS (5.5 m/s)
Service Pressure	450 PSI (31 BAR) - UL
Service Use	Automatic Sprinkler NFPA-13 One or two family dwelling NFPA-13D Residential occupancy up to four stories NFPA-13R National Fire Alarm Code NFPA-72

Specifications subject to change without notice.

Installation (see Fig. 1)

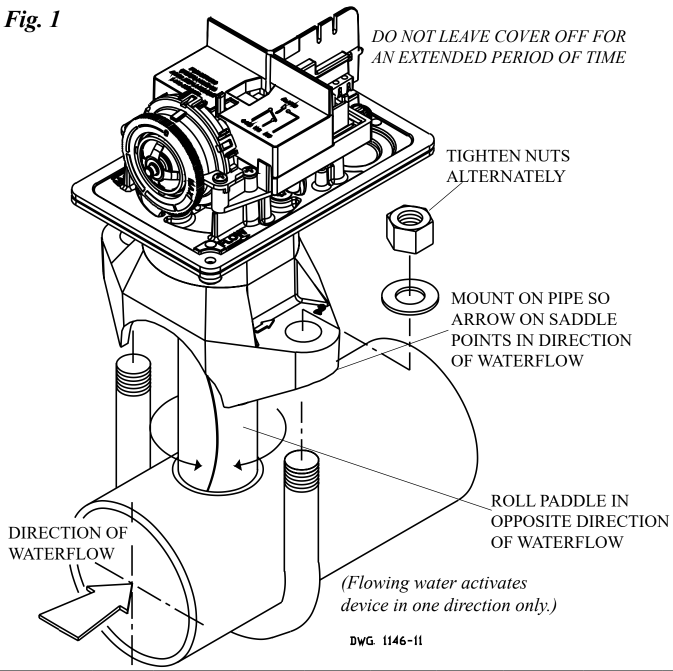
These devices may be mounted on horizontal or vertical pipe. On horizontal pipe they shall be installed on the top side of the pipe where they will be accessible. The device should not be installed within 6" (15 cm) of a fitting which changes the direction of the waterflow or within 24" (60 cm) of a valve or drain.
NOTE*:* Do not leave cover off for an extended period of time.

Drain the system and drill a hole in the pipe using a hole saw in a slow speed drill (see Fig. 1). Clean the inside pipe of all growth or other material for a distance equal to the pipe diameter on either side of the hole. Roll the vane so that it may be inserted into the hole; do not bend or crease it. Insert the vane so that the arrow on the saddle points in the direction of the waterflow. Take care not to damage the non-corrosive bushing in the saddle. The bushing should fit inside the hole in the pipe. Install the saddle strap and tighten nuts alternately to required torque (see the chart in Fig. 1). The vane must not rub the inside of the pipe or bind in any way.

⚠ CAUTION

Do not trim the paddle. Failure to follow these instructions may prevent the device from operating and will void the warranty. Do not obstruct or otherwise prevent the trip stem of the flow switch from moving when water flows as this could damage the flow switch and prevent an alarm. If an alarm is not desired, a qualified technician should disable the alarm system.

Fig. 1



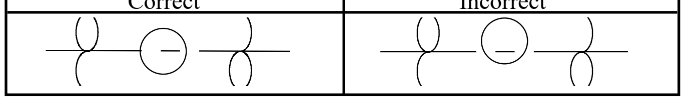
Retard Adjustment

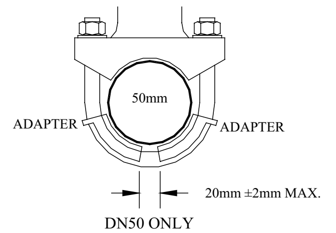
The delay can be adjusted by rotating the retard adjustment knob from 0 to the max setting (60-90 seconds). The time delay should be set at the minimum required to prevent false alarms

CAUTION

Hole must be drilled perpendicular to the pipe and vertically centered
Refer to the Compatible Pipe/Installation Requirements chart for size.

Correct	Incorrect

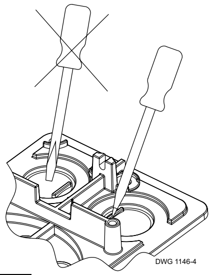




Compatible Pipe/ Installation Requirements

Model	Nominal Pipe Size		Nominal Pipe O.D.		Pipe Wall Thickness										Hole Size		U-Bolt Nuts Torque	
					Lightwall		Schedule 10 (UL)		Schedule 40 (UL)		BS-1387 (LPC)		DN (VDS)					
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	ft-lb	n-m
VSR-2	2	DN50	2.375	60.3	.065	1.651	0.109	2.77	0.154	3.91	0.142	3.6	0.091	2.3				
VSR-2 1/2	2.5	-	2.875	73.0	.084	2.134	0.120	3.05	0.203	5.16	-	-	-	-	1.25 + .125/-.062	33.0 ± 2.0		
VSR-2 1/2	-	DN65	3.000	76.1	-	-	-	-	-	-	0.142	3.6	0.102	2.6				
VSR-3	3	DN80	3.500	88.9	.083	2.108	0.120	3.05	0.216	5.49	0.157	4.0	0.114	2.9				
VSR-3 1/2	3.5	-	4.000	101.6	-	-	0.120	3.05	0.226	5.74	-	-	-	-			20	27
VSR-4	4	DN100	4.500	114.3	.084	2.134	0.120	3.05	0.237	6.02	0.177	4.5	0.126	3.2	2.00 ± .125	50.8 ± 2.0		
VSR-5	5	-	5.563	141.3	-	-	0.134	3.40	0.258	6.55	-	-	-	-				
VSR-6	6	DN150	6.625	168.3	.115	2.921	0.134	3.40	0.280	7.11	0.197	5.0	0.157	4.0				
VSR-8	8	DN200	8.625	219.1	-	-	0.148	3.76	0.322	8.18	0.248	6.3	0.177	4.5				

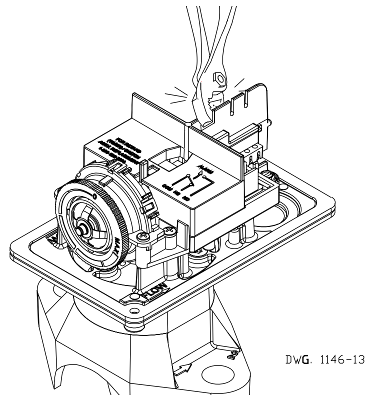
Fig. 2
To remove knockouts: Place screwdriver at inside edge of knockouts, not in the center.



NOTICE

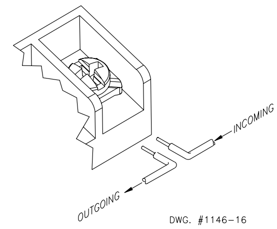
Do not drill into the base as this creates metal shavings which can create electrical hazards and damage the device. Drilling voids the warranty.

Fig. 3
Break out thin section of cover when wiring both switches from one conduit entrance.



Switch Terminal Connections Clamping Plate Terminal

Fig. 4



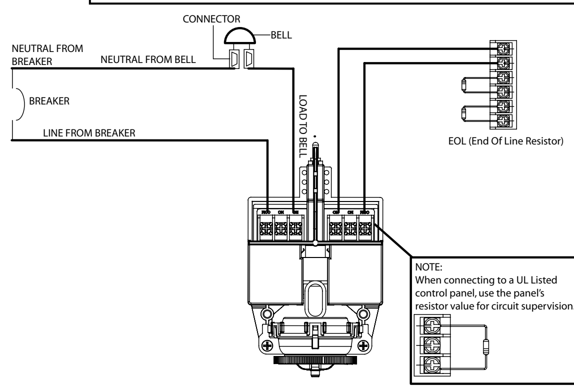
⚠ WARNING

An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire become dislodged from under the terminal. Failure to sever the wire may render the device inoperable risking severe property damage and loss of life.

Do not strip wire beyond 3/8" of length or expose an uninsulated conductor beyond the edge of the terminal block. When using stranded wire, capture all strands under the clamping plate.

Typical Electrical Connections

Fig. 5



Notes:

1. The Model VSR has two switches, one can be used to operate a central station, proprietary or remote signaling unit, while the other contact is used to operate a local audible or visual annunciator.
2. For supervised circuits, see "Switch Terminal Connections" drawing and warning note (Fig. 4).

Testing

The frequency of inspection and testing for the Model VSR and its associated protective monitoring system shall be in accordance with applicable NFPA Codes and Standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

If provided, the inspector's test valve shall always be used for test purposes. If there are no provisions for testing the operation of the flow detection device on the system, application of the VSR is not recommended or advisable.
A minimum flow of 10 GPM (38 LPM) is required to activate this device.

Fig. 6 Mounting Dimensions

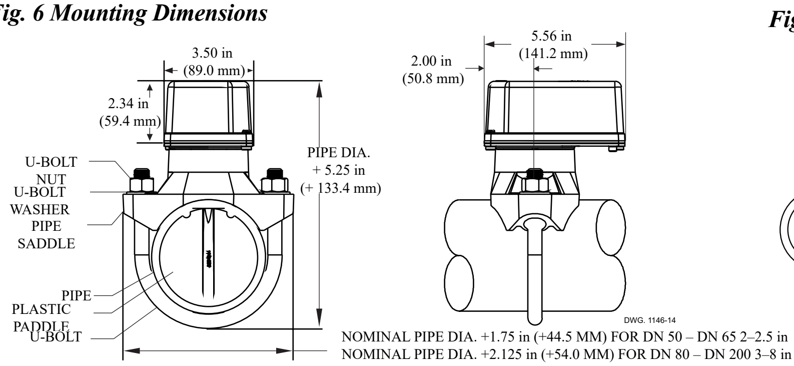
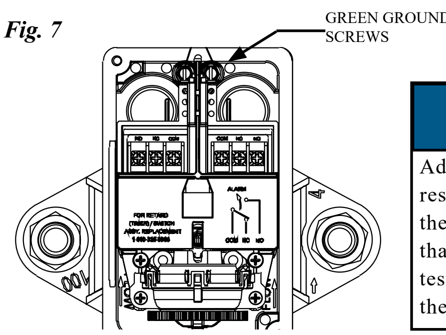


Fig. 7



NOTICE

Advise the person responsible for testing of the fire protection system that this system must be tested in accordance with the testing instructions.

Maintenance

Inspect detectors monthly. If leaks are found, replace the detector. The VSR waterflow switch should provide years of trouble-free service. The retard and switch assembly are easily field replaceable. In the unlikely event that either component does not perform properly, please order replacement retard switch assembly stock #1029030 (see Fig. 8). There is no maintenance required, only periodic testing and inspection.

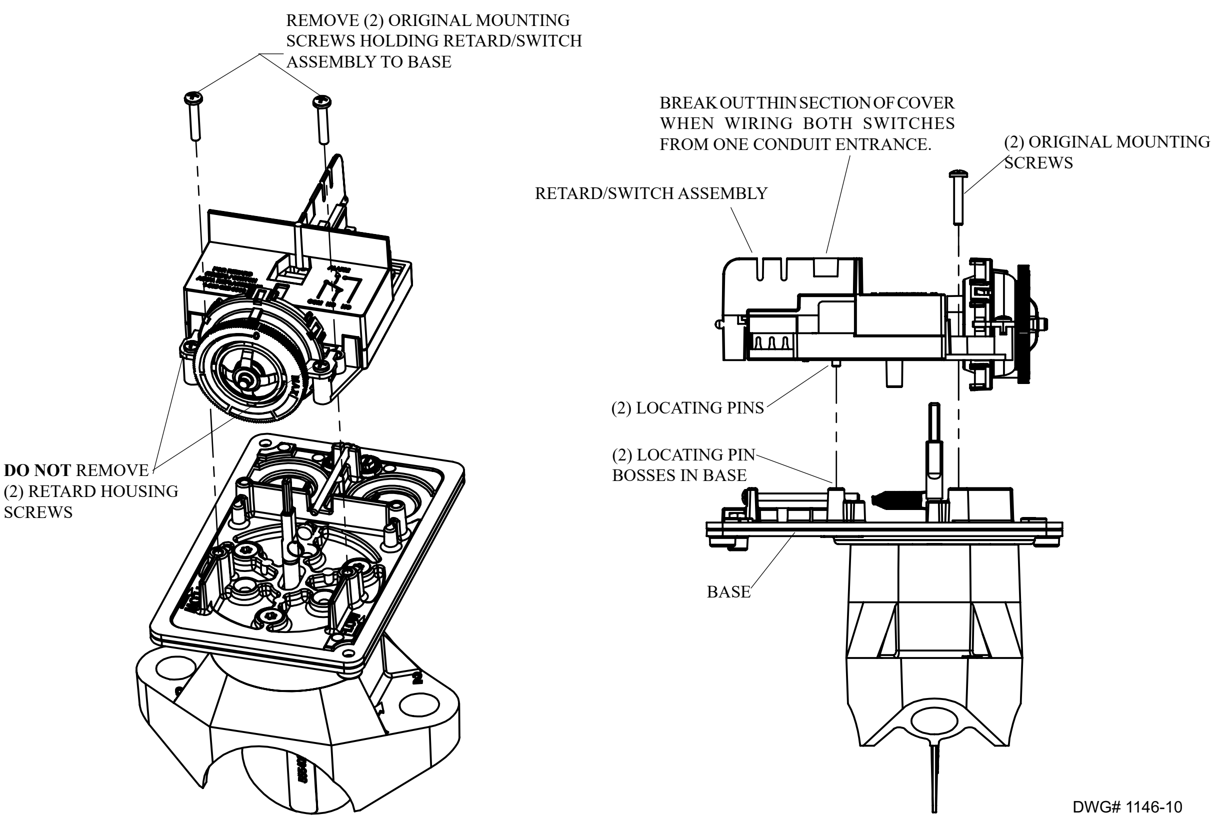
Retard/Switch Assembly Replacement (See Fig. 8)

1. Make sure the fire alarm zone or circuit connected to the waterflow switch is bypassed or otherwise taken out of service.
2. Disconnect the power source for local bell (if applicable).
3. Identify and remove all wires from the waterflow switch.
4. Remove the (2) mounting screws holding retard/switch assembly to the base. **Do not** remove the (2) retard housing screws.
5. Remove the retard assembly by lifting it straight up over the tripstem.
6. Install the new retard assembly. Make sure the locating pins on the retard/switch assembly fit into the locating pin bosses on the base.
7. Re-install the (2) original mounting screws.
8. Reconnect all wires. Perform a flow test and place the system back in service.

NOTICE

The Retard/Switch Assembly is field-replaceable without draining the system or removing the waterflow switch from the pipe

Fig. 8



Removal of Waterflow Switch

- To prevent accidental water damage, all control valves should be shut tight and the system completely drained before waterflow detectors are removed or replaced.
- Turn off electrical power to the detector, then disconnect wiring.
- Loosen nuts and remove U-bolts.
- Gently lift the saddle far enough to get your fingers under it. With your fingers, roll the vane so it will fit through the hole while continuing to lift the waterflow detector saddle.
- Lift detector clear of pipe.

NOTICE

Flow switches have a normal service life of 10-15 years. However, the service life may be significantly reduced by local environmental conditions.

Ordering Information

Model	Nominal Pipe Size		Part Number
VSR-2	2"	DN50	1144402
VSR-2 1/2	2 1/2"	DN65	1144425
VSR-3	3"	DN80	1144403
VSR-3 1/2	3 1/2"	-	1144435
VSR-4	4"	DN100	1144404
VSR-5	5"	-	1144405
VSR-6	6"	DN150	1144406
VSR-8	8"	DN200	1144408

Optional: Cover Tamper Switch Kit, stock no. 0090148
FSBS-FLOWSWITCH BYPASS SWITCH, stock no. 3001006
Replaceable Components: Retard/Switch Assembly, stock no. 1029030

POTTER
The Symbol of Protection

PS10 Series
Pressure Switch

Features

- One or two switch models available
- Independent switch adjustment on two switch models, no tools needed
- Two 1/2” conduit/cable entrances
- Separate isolated wiring chambers
- Non-corrosive pressure connection
- VdS version available
- Non-Conductive enclosure

NOTICE

This document contains important information on the installation and operation of PS10 pressure switches. Please read all instructions carefully before beginning installation. A copy of this document is required by NFPA 72 to be maintained on site.

Installation

The Potter PS10 Series Pressure Actuated Switches are designed for the detection of a waterflow condition in automatic fire sprinkler systems of particular designs such as wet pipe systems with alarm check valves, dry pipe, preaction, or deluge valves. The PS10 is also suitable to provide a low pressure supervisory signal; adjustable between 4 and 15 psi (0,27 and 1,03 bar).

1. Apply Teflon tape to the threaded male connection on the device. (Do not use pipe dope)
2. Device should be mounted in the upright position (threaded connection down).
3. Tighten the device using a wrench on the flats on the device.

Wiring Instructions

1. Remove the tamper resistant screw with the special key provided.
2. Carefully place a screwdriver on the edge of the knockout and sharply apply a force sufficient to dislodge the knockout plug. See Fig 9.
3. Run wires through an approved conduit connector and affix the connector to the device. NEMA 4 rated conduit and fittings are required for outdoor use.
4. Connect the wires to the appropriate terminal connections for the service intended. See Figures 2,4,5, and 6. See Fig. 7 for two switch, one conduit wiring.

Technical Specifications

Conduit Entrances	Two knockouts for 1/2” conduit provided. Individual switch compartments and ground screw suitable for dissimilar voltages
Contact Ratings	SPDT (Form C) 10.1 Amps at 125/250VAC, 2.0 Amps at 30VDC One SPDT in PS10-1, Two SPDT in PS10-2
Cover Tamper	Cover incorporates tamper resistant fastener that requires a special key for removal. One key is supplied with each device.
Differential	2 psi (0,13 bar) typical
Dimensions	3.78”(9,6cm)Wx3.20”(8,1cm)Dx4.22”(10,7cm)H
Enclosure	Cover: Weather/UV/Flame Resistant High Impact Composite Base: Die Cast All parts have corrosion resistant finishes
Environmental Limitations	-40º F to 140ºF (-40ºC to 60ºC) NEMA 4/IP66 Rated Enclosure indoor or outdoor when used with NEMA 4 conduit fittings
Factory Adjustment	4 - 8 psi (0,27 - 0,55 bar)
Maximum System Pressure	300 psi (20,68 bar)
Pressure Connection	Nylon 1/2” NPT male
Pressure Range	4-15 psi (0,27 - 1,03 bar)
Service Use	NFPA 13, 13D, 13R, 72

*Specifications subject to change without notice.

Testing and Adjustment

NOTE: Testing the PS10 may activate other system connected devices. The operation of the pressure alarm switch should be tested upon completion of installation and periodically thereafter in accordance with the applicable NFPA codes and standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently). There should be no need to adjust the PS10 when it is used as a pressure type waterflow indicator. It is factory set to comply with UL and FM standards.

Wet System

Method 1: When using PS10 and control unit with retard - connect PS10 into alarm port piping on the input side of retard chamber and electrically connect PS10 to control unit that provides a retard to compensate for surges. Insure that no unsupervised shut-off valves are present between the alarm check valve and PS10.

Method 2: When using the PS10 for local bell application or with a control that does not provide a retard feature - the PS10 must be installed on the alarm outlet side of the retard chamber of the sprinkler system.

Testing: Accomplished by opening the inspector’s end-of-line test valve. Allow time to compensate for system or control retard.

NOTE: Method 2 is not applicable for remote station service use, if there is an unsupervised shut-off valve between the alarm check valve and the PS10.

Wet System With Excess Pressure

Connect PS10 into alarm port piping extending from alarm check valve. Retard provisions are not required. Insure that no unsupervised shut-off valves are present between the alarm check valve and the PS10.

Testing: Accomplished by opening the water by-pass test valve or the inspector’s end-of-line test valve. When using end-of-line test, allow time for excess pressure to bleed off.

Dry System

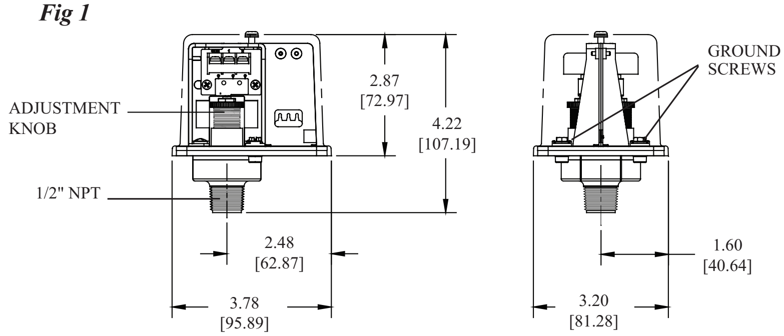
Connect PS10 into alarm port piping that extends from the intermediate chamber of the alarm check valve. Install on the outlet side of the in-line check valve of the alarm port piping. Insure that no unsupervised shut-off valves are present between the alarm check valve and the PS10.

Testing: Accomplished by opening the water by-pass test valve.

NOTE: The above tests may also activate any other circuit closer or water motor gongs that are present on the system.

Dimensions

Fig 1

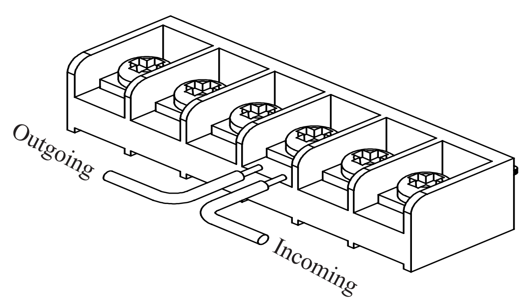


NOTE: To prevent leakage, apply Teflon tape sealant to male threads only.

DWG# 930-1

Switch Clamping Plate Terminal

Fig 2

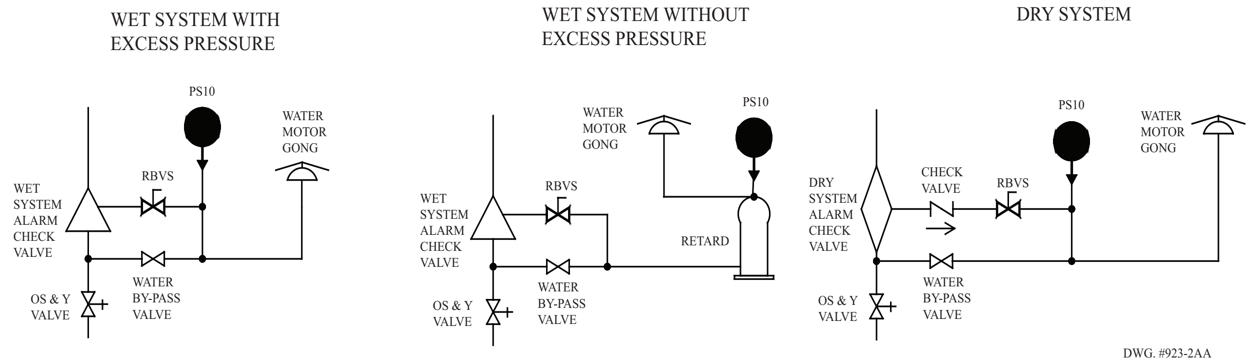


WARNING

An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire becomes dislodged from under the terminal.

Typical Sprinkler Applications

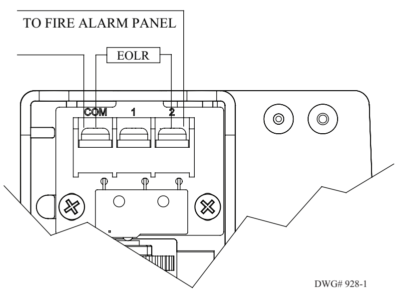
Fig 3



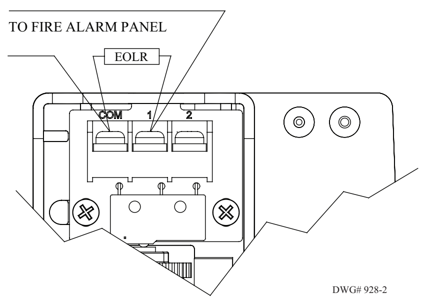
CAUTION

Closing of any shutoff valves between the alarm check valve and the PS10 will render the PS10 inoperative. To comply with NFPA-72 any such valve shall be electrically supervised with a supervisory switch such as Potter Model RBVS.

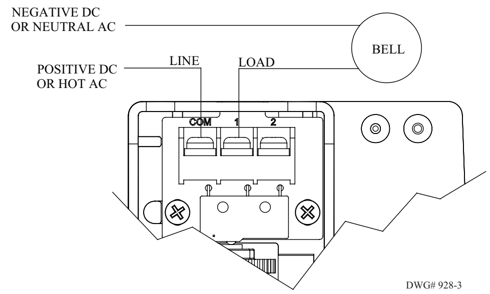
Low Pressure Signal Connection
Fig 4



Waterflow Signal Connection
Fig 5



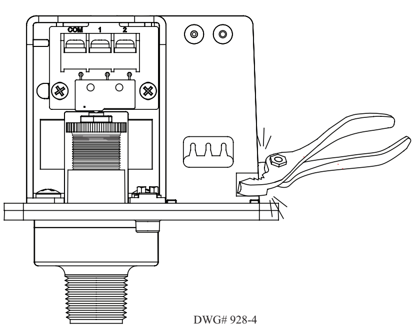
Local Bell For Waterflow Connection
Fig 6



One Conduit Wiring

Fig 7

Break out thin section of divider to provide path for wires when wiring both switches from one conduit entrance.

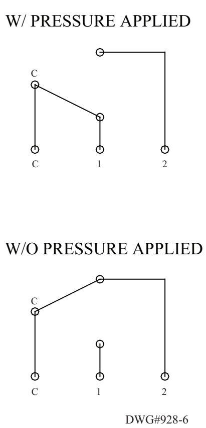


Switch Operation

Fig 8

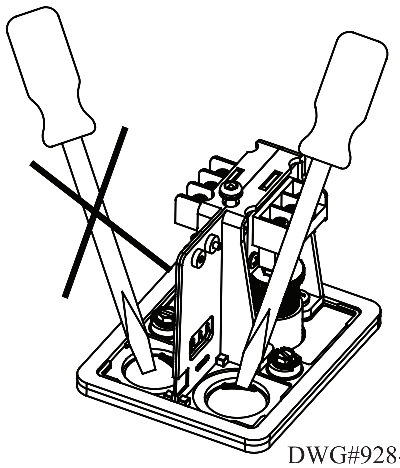
Terminal
C: Common
1: Closed when installed under normal system pressure.
2: Open when installed under normal system pressure. Closes on pressure drop. Use for low pressure supervision.

Terminal
1: Open with no pressure supplied. Closes upon detection of pressure. Use for waterflow indication.
2: Closed with no pressure applied.



Removing Knockouts

Fig 9



DWG#928-5

Engineer/Architect Specifications Pressure Type Waterflow Switch

Pressure type waterflow switches; shall be a Model PS10 as manufactured by Potter Electric Signal Company, St Louis MO., and shall be installed on the fire sprinkler system as shown and or specified herein.

Switches shall be provided with a ½" NPT male pressure connection and shall be connected to the alarm port outlet of; Wet Pipe Alarm Valves, Dry Pipe Valves, Pre-Action Valves, or Deluge Valves. The pressure switch shall be actuated when the alarm line pressure reaches 4 - 8 psi (0,27 - 0,55 bar).

Pressure type waterflow switches shall have a maximum service pressure rating of 300 psi (20,68 bar) and shall be factory adjusted to operate on a pressure increase of 4 - 8 psi (0,27 - 0,55 bar)

Pressure switch shall have one or two form C contacts, switch contact rating 10.1 Amps at 125/250 VAC, 2.0 Amps at 30 VDC.

Pressure type waterflow switches shall have two conduit entrances one for each individual switch compartment to facilitate the use of dissimilar voltages for each individual switch.

The cover of the pressure type waterflow switch shall be Weather/UV/Flame Resistant High Impact Composite with rain lip and shall attach with one tamper resistant screw. The Pressure type waterflow switch shall be suitable for indoor or outdoor service with a NEMA 4/IP66 rating.

The pressure type waterflow switch shall be UL Ulc and CSFM listed, FM and LPC approved and NYMEA accepted.

⚠ WARNING

- Installation must be performed by qualified personnel and in accordance with all national and local codes and ordinances.
- Shock hazard. Disconnect power source before servicing. Serious injury or death could result.
- Read all instructions carefully and understand them before starting installation. Save instructions for future use. Failure to read and understand instructions could result in improper operation of device resulting in serious injury or death.
- Risk of explosion. Not for use is hazardous locations. Serious injury or death could result.

⚠ CAUTION

- Do not tighten by grasping the switch enclosure. Use wrenching flats on the bushing only. Failure to install properly could damage the switch and cause improper operation resulting in damage to equipment and property.
- To seal threads, apply Teflon tape to male threads only. Using joint compounds or cement can obstruct the pressure port inlet and result in improper device operation and damage to equipment.
- Do not over tighten the device, standard piping practices apply.

Ordering Information

Model	Description	Part Number
PS10-1	Pressure switch with one set SPDT contacts	1340103
PS10-2	Pressure switch with two sets SPDT contacts	1340104
Hex Key		5250062
Cover Tamper Switch Kit		0090200

Tamper

Cover incorporates tamper resistant fastener that requires a special key for removal. One key is supplied with each device. For optional cover tamper switch kit, order Stock No. 0090200. See bulletin #5401200 PSCTSK.

NOTICE

Pressure switches have a normal service life of 10-15 years. However, the service life may be significantly reduced by local environmental conditions.

PS40 Series

Supervisory Pressure Switch

POTTER
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Features

- One or two switch models available
- Independent switch adjustment on two switch models, no tools needed
- Two 1/2” conduit/cable entrances
- Separate isolated wiring chambers
- Non-corrosive pressure connection
- Non-Conductive Enclosure
- Vds version available

NOTICE

This document contains important information on the installation and operation of PS40 pressure switches. Please read all instructions carefully before beginning installation. A copy of this document is required by NFPA 72 to be maintained on site.

Installation

The Potter PS40 Series Supervisory Pressure Actuated Switches are designed primarily to detect an increase and/or decrease from normal system pressure in automatic fire sprinkler systems. Typical applications are: air/nitrogen supervision in dry pipe and pre-action systems, pressure tanks, air supplies, and water supplies. The PS40-1 has one switch and is factory set to activate at approximately 30 psi (2,1 bar) on a decrease in pressure. The PS40-2 has two switches. The Low switch is factory set to activate at approximately 30 psi (2,1 bar) on a decrease in pressure. The High switch is factory set to activate at approximately 50 psi (3,5 bar) on an increase in pressure. NFPA 72 requires a supervisory signal if the pressure increases or decreases by 10 psi from normal. The PS40 is factory set for a normal air pressure of 40 psi. See section heading Adjustments and Testing if other than factory set point is required.

1. Connect the PS40 to the system side of any shutoff or check valve.
2. Apply Teflon tape to the threaded male connection on the device. (Do not use pipe dope)
3. Device should be mounted in the upright position. (Threaded connection down)
4. Tighten the device using a wrench on the flats on the device.

Technical Specifications

Conduit Entrances	Two knockouts for 1/2” conduit provided. Individual switch compartments and ground screw suitable for dissimilar voltages
Contact Ratings	SPDT (Form C) 10.1 Amps at 125/250 VAC, 2.0 Amps at 30 VDC One SPDT in PS40-1, Two SPDT in PS40-2
Cover Tamper	Cover incorporates tamper resistant fastener that requires a special key for removal. One key is supplied with each device.
Differential	Typical 1 lb. at 10 psi (,07 at ,7 bar) 4 lbs at 60 psi (,28 at 4,1 bar)
Dimensions	3.78”(9,6cm)Wx3.20”(8,1cm)Dx4.22”(10,7cm)H
Enclosure	Cover: Weather/UV/Flame Resistant High Impact Composite Base: Die Cast All parts have corrosion resistant finishes
Environmental Limitations	-40º F to 140ºF (-40ºC to 60ºC) NEMA 4/IP66 Rated Enclosure indoor or outdoor when used with NEMA 4 conduit fittings
Factory Adjustment	PS40-1 operates on decrease at 30 psi (2,1 bar) PS40-2 operates on increase at 50 psi (3,5 bar) and on decrease at 30 psi (2,1 bar)
Maximum System Pressure	300 psi (20,68 bar)
Pressure Connection	Nylon 1/2” NPT male
Pressure Range	10-60 psi (,7-4,1 bar)
Service Use	NFPA 13, 13D, 13R, 72

*Specifications subject to change without notice.

Wiring Instructions

1. Remove the tamper resistant screw with the special key provided.
2. If it is necessary to remove the sealed knockouts, carefully place a screwdriver on the edge of the knockout and sharply apply a force sufficient to dislodge the knockout plug. See Fig. 9.
3. Run wires through an approved conduit connector and affix the connector to the device. A NEMA-4 rated conduit fitting is required for outdoor use.
4. Connect the wires to the appropriate terminal connections for the service intended. See Figures 2,4,5 and 6. See Fig. 7 for two switch one conduit wiring.

Adjustment and Testing

NOTE: Testing the PS40 may activate other system connected devices. The operation of the pressure supervisory switch should be tested upon completion of installation and periodically thereafter in accordance with the applicable local, national and NFPA codes and standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

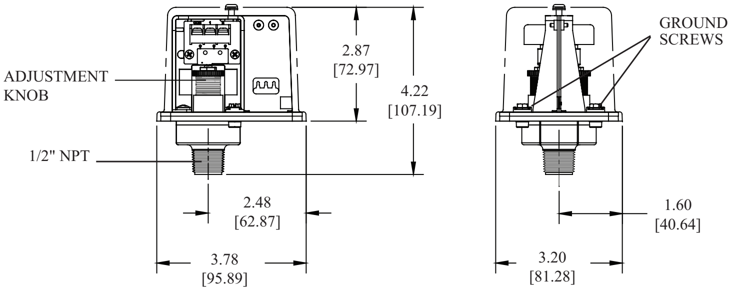
The use of a Potter BVL (see product bulletin 5400799 for details) is recommended to facilitate setting and testing of the PS40 pressure switch. When a BVL (bleeder valve) is used, the pressure to the switch can be isolated and bled from the exhaust port on the BVL without affecting the supervisory pressure of the entire system. See Fig. 3.

The operation point of the PS40 Pressure Switch can be adjusted to any point between 10 and 60 psi (0,7 - 4,11 bar) by turning the adjustment knob(s) clockwise to raise the actuation point and counter clockwise to lower the actuation point. In the case of the PS40-2, both switches operate independent of each other. Each switch may be independently adjusted to actuate at any point across the switch adjustment range. If the pressure needs to be adjusted from the factory settings, adjust the system pressure to the desired trip point. Use an ohmmeter on the appropriate contact (COM and 2 for pressure decrease and COM and 1 for pressure increase). Adjust the knurled knob until the meter changes state. At that point the switch is set for that particular pressure. Final adjustments should be verified with a pressure gauge.

The position of the top of the adjustment knob across to the printed scale on the switch bracket can be used to provide an approximate visual reference of the pressure switch setting.

Dimensions

Fig 1

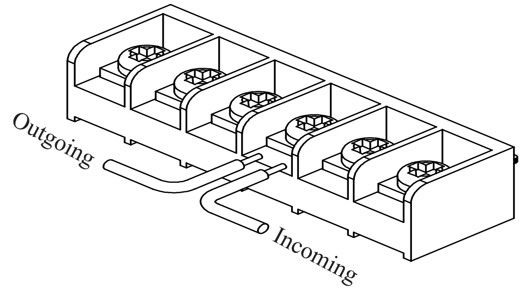


NOTE: To prevent leakage, apply Teflon tape sealant to male threads only.

DWG# 930-1

Switch Clamping Plate Terminal

Fig 2

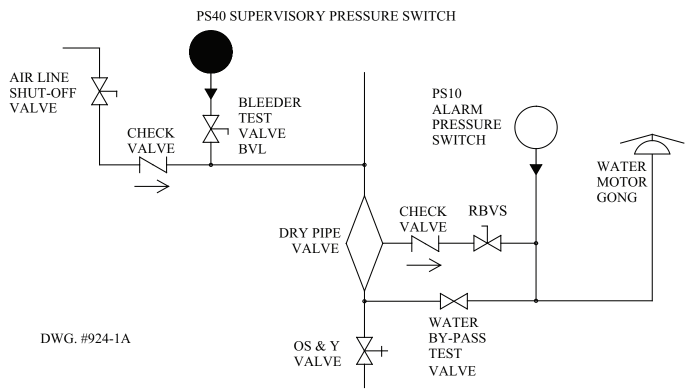


WARNING

An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire becomes dislodged from under the terminal.

Typical Sprinkler Applications

Fig 3



CAUTION

Closing of any shutoff valves between the alarm check valve and the PS10 will render the PS10 inoperative. To comply with IBC, IFC, and NFPA-13, any such valve shall be electrically supervised with a supervisory switch such as Potter Model RBVS.

POTTER
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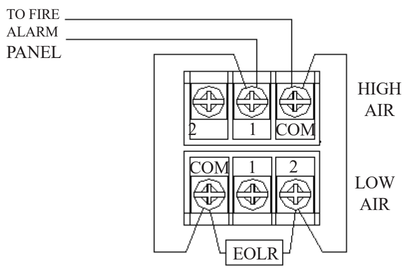
PS40 Series
Supervisory Pressure Switch

Typical Electrical Connections

Fig 4

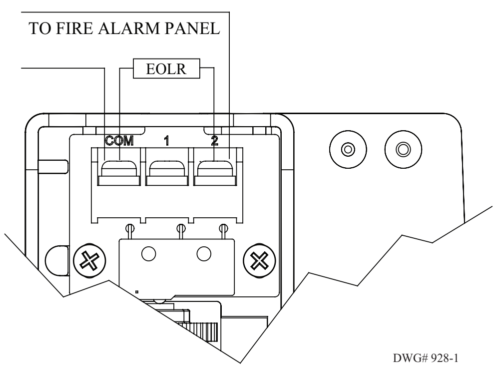


WITH NORMAL SYSTEM PRESSURE APPLIED HIGH - TERMINAL 1 WILL CLOSE ON PRESSURE INCREASE.

WITH NORMAL SYSTEM PRESSURE APPLIED LOW -TERMINAL 2 CLOSES ON PRESSURE DROP.

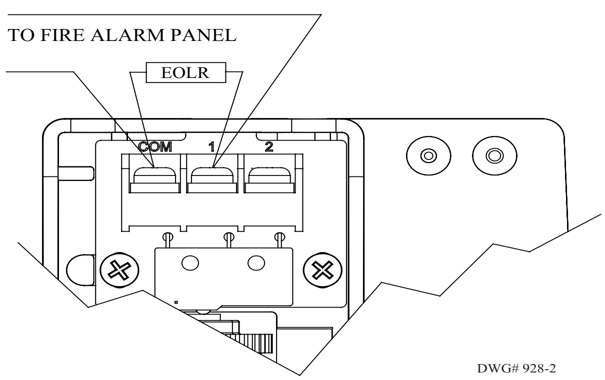
Low Pressure Signal Connection

Fig 5



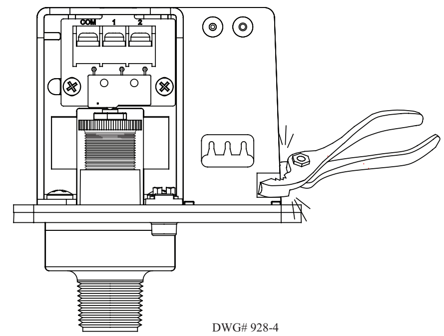
High Pressure Signal Connection

Fig 6



One Conduit Wiring

Fig 7



Changing Pressure

Fig 8

Low Pressure Switch High Pressure Switch

Terminal

C: Common

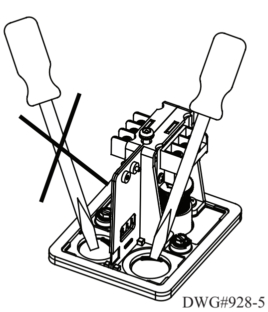
1. Closed when installed under normal system Pressure.
2. Open when installed under normal system pressure. Closes on pressure drop. Use for low air signal.

Terminal

1. Open when installed under normal system pressure. Closes on increase in pressure. Use for high air signal.
2. Closed under normal system pressure.

Removing Knockouts

Fig 9



Engineer/Architect Specifications
Pressure Type Waterflow Switch

Pressure type supervisory switches; shall be a Model PS40 as manufactured by Potter Electric Signal Company, St. Louis, MO., and shall be installed on the fire sprinkler system as shown and or specified herein.

Switches shall be provided with a 1/2" NPT male pressure connection to be connected into the air supply line on the system side of any shut-off valve. A Model BVL bleeder valve as supplied by Potter Electric Signal Company of St. Louis, MO., or equivalent shall be connected in line with the PS40 to provide a means of testing the operation of the supervisory switch. (See Fig. 3)

The switch unit shall contain SPDT (Form C) switch(es). One switch shall be set to operate at 30 psi (2,1 bar) on a pressure decrease. If two switches are provided, the second switch shall be set to operate at a 50 psi (3,5 bar) on a pressure increase.

Switch contacts shall be rated at 10.1 Amps at 125/250VAC and 2.0 Amps at 30VDC. The units shall have a maximum pressure rating of 300 psi (20,68 bar) and shall be adjustable from 10 to 60 psi (0,7 to 4,1 bar).

Pressure switches shall have two conduit entrances, one for each individual switch compartment to facilitate the use of dissimilar voltages for each individual switch.

The cover of the pressure switch shall be Weather/UV/Flame Resistant High Impact Composite with rain lip and shall attach with one tamper resistant screw. The pressure switch shall be suitable for indoor or outdoor service with a NEMA-4/IP66 rating.

The pressure switch shall be UL, ULC, and CSFM listed, FM and LPC approved and NYMEA accepted.

WARNING

- Installation must be performed by qualified personnel and in accordance with all national and local codes and ordinances.
- Shock hazard. Disconnect power source before servicing. Serious injury or death could result.
- Read all instructions carefully and understand them before starting installation. Save instructions for future use. Failure to read and understand instructions could result in improper operation of device resulting in serious injury or death.
- Risk of explosion. Not for use is hazardous locations. Serious injury or death could result.

CAUTION

- Do not tighten by grasping the switch enclosure. Use wrenching flats on the bushing only. Failure to install properly could damage the switch and cause improper operation resulting in damage to equipment and property.
- To seal threads, apply Teflon tape to male threads only. Using joint compounds or cement can obstruct the pressure port inlet and result in improper device operation and damage to equipment.
- Do not over tighten the device, standard piping practices apply.
- Do not apply any lubricant to any component of the pressure switch.

Ordering Information

Model	Description	Stock No.
PS40-1	Pressure Switch with one set SPDT contacts	1340403
PS40-2	Pressure Switch with two sets SPDT contacts	1340404
	Hex Key	5250062
BVL	Bleeder Valve	1000018
	Optional Cover Tamper Switch Kit	0090200

NOTICE

Pressure switches have a normal service life of 10-15 years. However, the service life may be significantly reduced by local environmental conditions.

POTTER
The Symbol of Protection

OSYSU Series

Outside Screw and Yoke Valve Supervisory Switch

Features

- NEMA 4X* (IP 65) and 6P (IP 67)
  **Enclosure is 4X. For additional corrosion protection of mounting hardware, use model OSYSU-2 CRH*
- -40º to 140º (-40ºC to 60ºC) operating temperature range
- Visual switch indicators
- Two conduit entrances
- Adjustable length trip rod
- Accomodates up to 12AWG wire
- Three position switch detects tampering and valve closure
- Knurled mounting bracket prevents slipping
- Fine adjustment feature for fast, easy installation
- RoHS compliant
- One or two SPDT contact models (-1,-2)

NOTICE

Before any work is done on the fire sprinkler or fire alarm system, the building owner or their authorized representative shall be notified. Before opening any closed valve, ensure that opening the valve will not cause any damage from water flow due to open or missing sprinklers, piping, etc.

Important: This document contains important information on the installation and operation of OS&Y valve supervisory switches. Please read all instructions carefully before beginning installation. A copy of this document is required by NFPA 72 to be maintained on site.

Description

The OSYSU is used to monitor the open position of an OS&Y (outside screw and yoke) type gate valve. This device is available in two models; the OSYSU-1, containing one set of SPDT (Form C) contacts and the OSYSU-2, containing two sets of SPDT (Form C) contacts. These switches mount conveniently to most OS&Y valves ranging in size from 2” to 12” (50mm to 300mm). They will mount on some valves as small as ½” (12,5mm).
The cover is held in place by two tamper resistant screws that require a special tool to remove. The tool is furnished with each device.

Testing

The operation of the OSYSU and its associated protective monitoring system shall be inspected, tested, and maintained in accordance with all applicable local and national codes and standards and/or the Authority Having Jurisdiction (manufacturer recommends quarterly or more frequently). A minimum test shall consist of turning the valve wheel towards the closed position. The OSYSU shall operate within the first two revolutions of the wheel. Fully close the valve and ensure that the OSYSU does not restore. Fully open the valve and ensure that the OSYSU restores to normal only when the valve is fully opened.

⚠ CAUTION

Close the valve fully to determine that the stem threads do not activate the switch. The switch being activated by the stem threads could result in a ***false valve open*** indication.

Technical Specifications

Dimensions	See Fig 8
Weight	1.6 lbs (0,73 kg)
Enclosure	Cover: Die Cast Finish: Red Powder Coat Base: Die Cast Finish: Black Powder Coat All parts have corrosion resistant finishes
Cover Tamper	Tamper Resistant Screws Optional Cover Tamper Switch Available
Contact Ratings	OSYSU-1: One Set of SPDT (Form C) OSYSU-2: Two Sets of SPDT (Form C) 10.0 Amps at 125/250 VAC 2.0 Amps at 30VDC Resistive 10 mAmps minimum at 24 VDC
Environmental Limitations	-40º F to 140ºF (-40ºC to 60ºC) NEMA 4X (IP 65) and NEMA 6P (IP 67) Enclosure (Use suitably rated conduit and connector) Indoor or Outdoor Use (See OSYSU-EX Bulletin 5400705 for Hazardous locations)
Conduit Entrances	Two Knockouts for 1/2” conduit provided (See Notice on Page 6 and Fig. 9 on Page 5)
Service Use	NFPA 13, 13D, 13R, 72

Specifications subject to change without notice

Theory of Operation

The OSYSU is a 3 position switch. The center position is the normal installation position. Normal is when the switch is installed on the OS&Y valve, the valve is fully open and the trip rod of the OSYSU is in the groove of the valve stem. Closing the valve causes the trip rod to ride up out of the groove and activates the switches. Removing the OSYSU from the valve causes the spring to pull the trip rod in the other direction and activates the switches.

Visual Switch Status Indication

There are 3 visual indicators to determine the status of the switches.

Fig 1; the actuator button of the micro switches are on the raised section of the switch actuator.

Fig 2; the trip rod is perpendicular to the base and lined up with the alignment mark on the mounting bracket.

Fig 3; the white visual indicator is visible through the window on the back of the switch actuator.

A final test is to meter the contacts marked COM and N.O. to ensure they are an open circuit when the valve is open and that they close and have continuity within 2 revolutions of turning the valve handwheel towards the closed position and the contacts remain closed as the valve is completely closed and until the valve is completely opened when the trip rod drops back into the groove in the valve stem.

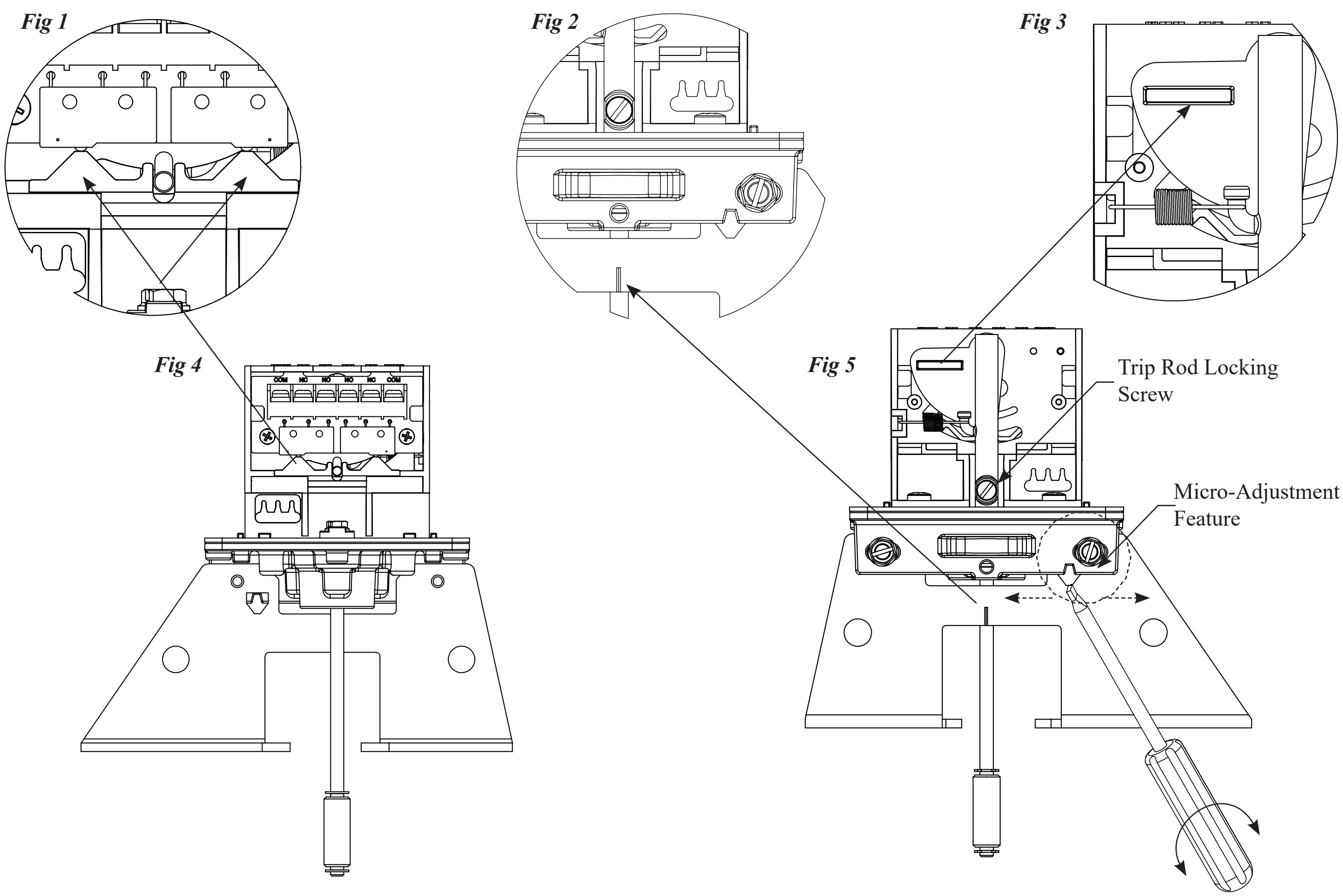
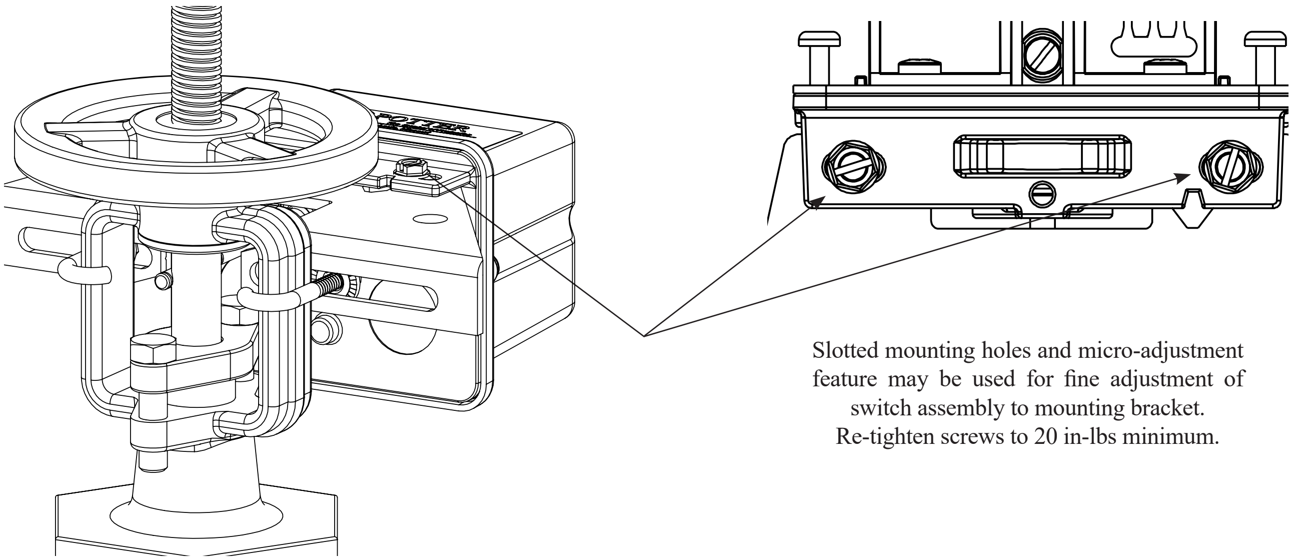


Fig 6

Small Valve Installation - 1/2” Through 2 1/2” Sizes



Small Valve Installation

NOTE: If the valve stem is pre-grooved at 1/8” minimum depth; proceed to step 7.

1. Remove and discard "E" ring and roller from the trip rod.
2. With the valve in the FULL OPEN position, locate the OSYSU across the valve yoke as far as possible from the valve gland so that the spring loaded trip rod of the OSYSU is pulled against the non threaded portion of the valve stem. Position the OSYSU with the bracket near the handwheel as shown in Fig. 6 if possible to avoid creating a pinch point between the wheel and the OSYSU.
3. Loosen the locking screw that holds the trip rod in place and adjust the rod length (see Fig. 5). When adjusted properly, the rod should extend past the valve screw, but not so far that it contacts the clamp bar. Tighten the locking screw to 5 in-lbs minimum to hold the trip rod in place and properly seal the enclosure.

   NOTE: If trip rod length is excessive, loosen the locking screw and remove the trip rod from the trip lever. Using pliers, break off the one (1) inch long notched section (see Fig. 10). Reinstall trip rod and repeat Step 3 procedure.
4. Mount the OSYSU loosely with the carriage bolts and clamp bar supplied. On valves with limited clearance use J-hooks supplied instead of the carriage bolts and clamp bar to mount the OSYSU.
5. Mark the valve stem at the center of the trip rod.
6. Remove the OSYSU. Utilizing a 3/16” or 1/4” diameter straight file, file a 1/8” minimum depth groove centered on the mark on the valve stem. Deburr and smooth the edges of the groove to prevent damage to the valve packing and to allow the trip rod to move easily in and out of the groove as the valve is operated.

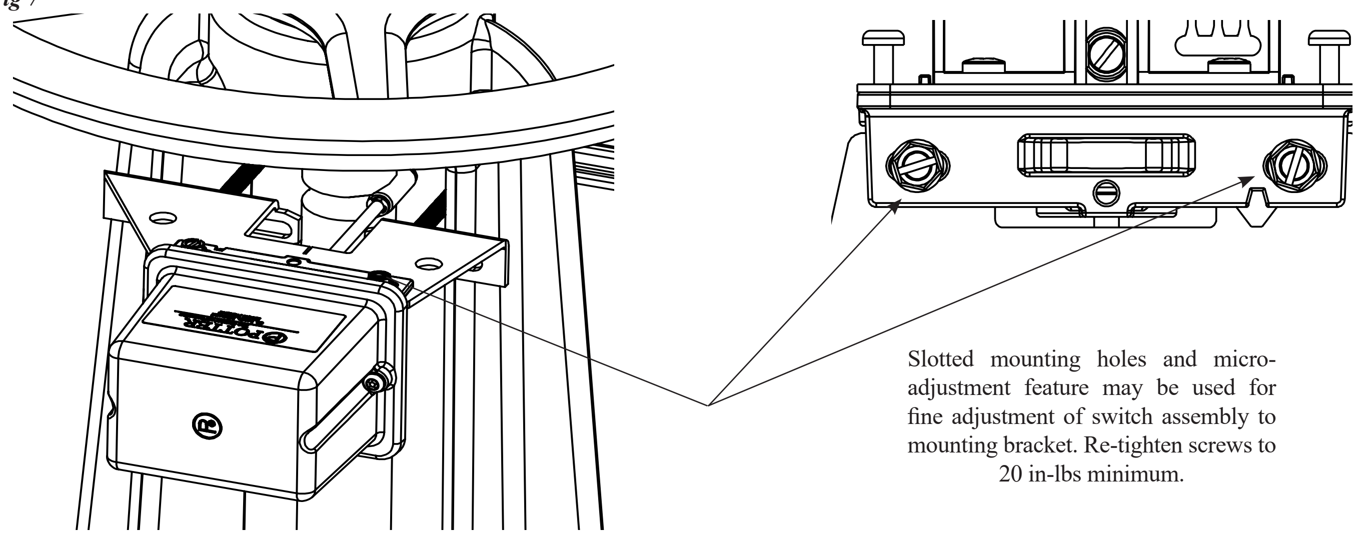
   NOTE: A groove depth of up to approximately 3/16” can make it easier to install the OSYSU so that it does not restore as it rolls over by the threads of the valve stem.
7. Mount the OSYSU on the valve yoke with the spring loaded trip rod of the OSYSU pulled against the valve stem and centered in the groove of the stem. If possible, position the OSYSU with the flat side of the bracket toward the hand wheel, as shown in Fig. 6, to help avoid creating a pinch point between the wheel and OSYSU. When in this preferred mounting position, it is usually best to use the white indicator visible through the window, as illustrated in Fig. 3, to aid in initially locating the OSYSU in the correct position on the yoke. If the unit must be installed inverted with the white indicator no longer easily visible, use the visual indicators of the actuator buttons on the micro-switches, as illustrated in Fig. 1, or the trip rod alignment mark on the bracket, as illustrated in Fig. 2 , to aid in initially locating the OSYSU.
8. Final adjustment can be made by slightly loosening the two screws on the bracket and using the fine adjustment feature (see Fig. 5). The adjustment is correct when the plungers on the switches are depressed by the actuator and there is no continuity between the COM and NO terminals on the switches.
9. Tighten the adjustment screws and all mounting hardware securely (20 in-lbs minimum). Check to insure that the rod moves out of the groove easily and that the switches activate within two turns when the valve is operated from the FULL OPEN towards the CLOSED position.
10. Reinstall the cover and tighten the cover screws to 15 in-lbs minimum to properly seal the enclosure.

⚠ CAUTION

Close the valve fully to determine that the stem threads do not activate the switch. The switch being activated by the stem threads could result in a ***false valve open*** indication.

Large Valve Installation - 3” Through 12” Sizes

Fig 7



Large Valve Installation

NOTE: If the valve stem is pre-grooved at 1/8” minimum depth; proceed to step 6.

1. With the valve in the FULL OPEN position, locate the OSYSU across the valve yoke as far from the valve gland as possible so that the spring loaded trip rod of the OSYSU is pulled against the non threaded portion of the valve stem. Position the OSYSU with the bracket near the handwheel as shown in Fig. 7 if possible to avoid creating a pinch point between the wheel and the OSYSU.

2. Mount the OSYSU loosely with the carriage bolts and clamp bar supplied.

3. Loosen the locking screw that holds the trip rod in place and adjust the rod length (see Fig. 5). When adjusted properly, the rod should extend past the valve screw, but not so far that it contacts the clamp bar. Tighten the locking screw to 5 in-lbs minimum to hold the trip rod in place and properly seal the enclosure.

NOTE: If trip rod length is excessive, loosen the locking screw and remove the trip rod from the trip lever. Using pliers, break off the one (1) inch long notched section (see Fig. 10). Reinstall trip rod and repeat Step 3 procedure.

4. Mark the valve stem at the center of the trip rod.

5. Remove the OSYSU. Utilizing a 3/8” or ½” diameter straight file, file a 1/8” minimum depth groove centered on the mark on the valve stem. Deburr and smooth the edges of the groove to prevent damage to the valve packing and to allow the trip rod to move easily in and out of the groove as the valve is operated.

NOTE: A groove depth of up to approximately 3/16” can make it easier to install the OSYSU so that it does not restore as it rolls over by the threads of the valve stem.

6. Mount the OSYSU on the valve yoke with the spring loaded trip rod of the OSYSU pulled against the valve stem and centered in the groove of the stem. If possible, position the OSYSU with the flat side of the bracket toward the hand wheel, as shown in Fig. 7, to help avoid creating a pinch point between the wheel and OSYSU. When in this preferred mounting position, it is usually best to use the white indicator visible through the window, as illustrated in Fig. 3, to aid in initially locating the OSYSU in the correct position on the yoke. If the unit must be installed inverted with the white indicator no longer easily visible, use the visual indicators of the actuator buttons on the micro-switches, as illustrated in Fig. 1, or the trip rod alignment mark on the bracket, as illustrated in Fig. 2 , to aid in initially locating the OSYSU.

7. Final adjustment can be made by slightly loosening the two screws on the bracket and using the fine adjustment feature (see Fig. 5). The adjustment is correct when the plungers on the switches are depressed by the actuator and there is no continuity between the COM and NO terminals on the switches.

8. Tighten the adjustment screws and mounting hardware securely (minimum 20 in-lbs). Check to insure that the rod moves out of the groove easily and that the switches activate within two turns when the valve is operated from the FULL OPEN towards the CLOSED position.

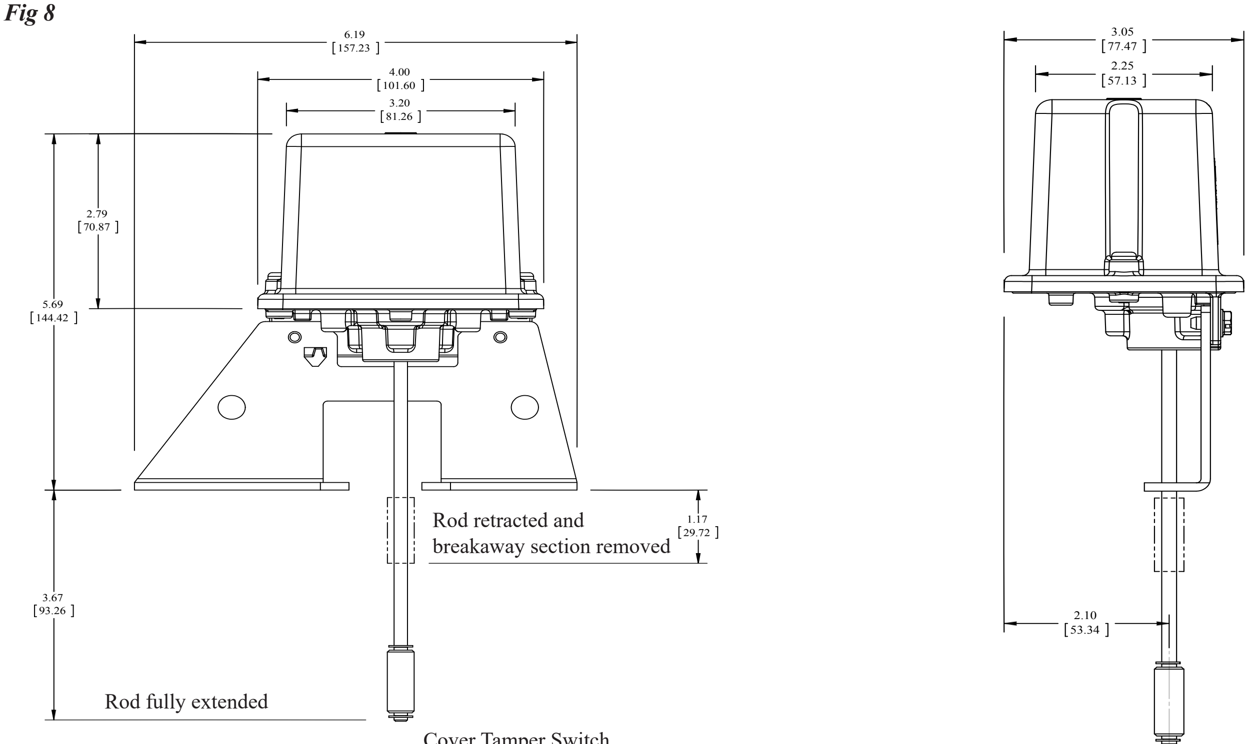
9. Reinstall the cover and tighten the cover screws to 15 in-lbs minimum to properly seal the enclosure.

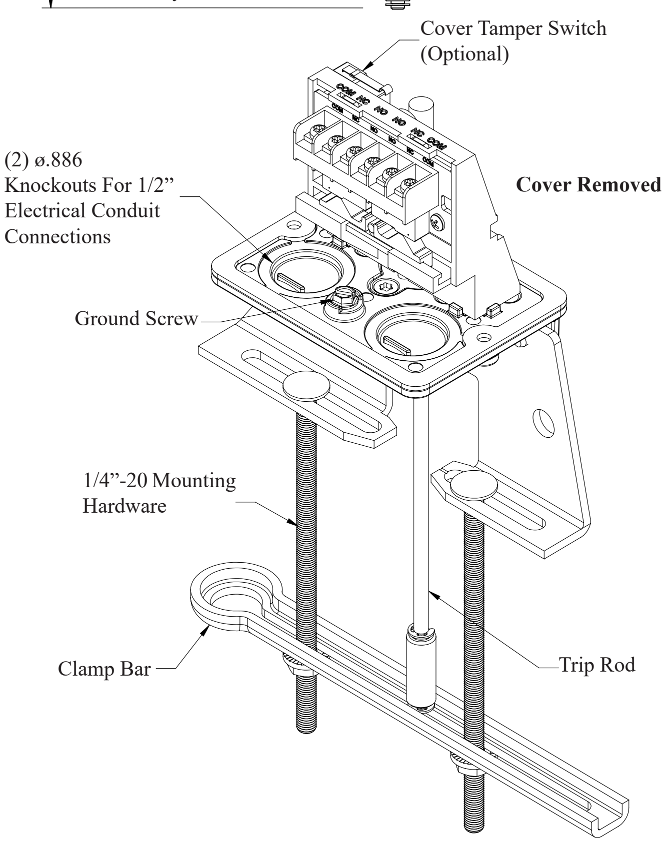
⚠ CAUTION

Close the valve fully to determine that the stem threads do not activate the switch. The switch being activated by the stem threads could result in a ***false valve open*** indication.

Dimensions

Fig 8

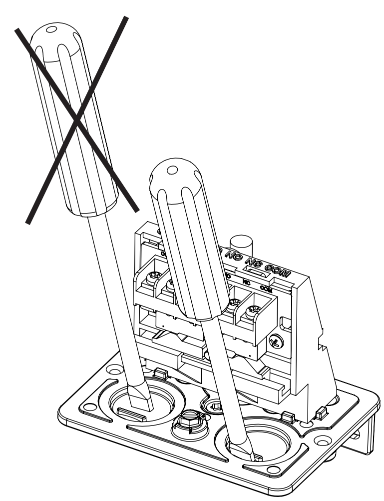




Knockout Removal

Fig 9

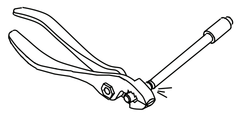
To remove knockouts: Place screwdriver at inside edge of knockouts, not in the center.



NOTE: Do not drill into the base as this creates metal shavings which can create electrical hazards and damage the device. Drilling voids the warranty.

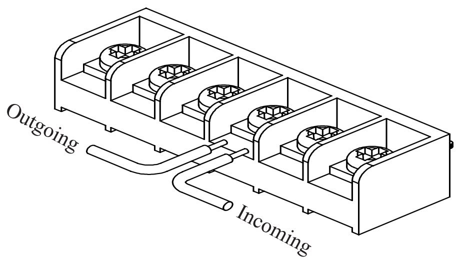
Breaking Excessive Rod Length

Fig 10



Switch Terminal Connections Clamping Plate Terminal

Fig 11



⚠ WARNING

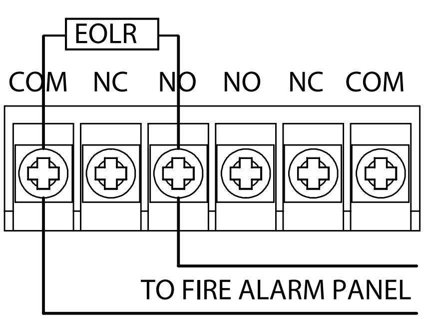
An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire become dislodged from under the terminal. Failure to sever the wire may render the device inoperable risking severe property damage and loss of life. Do not strip wire beyond 3/8" of length or expose an uninsulated conductor beyond the edge of the terminal block. When using stranded wire, capture all strands under the clamping plate.

NOTICE

All conduit and connectors selected for the installation of this product shall be suitable for the environment for which it is to be used and shall be installed to the manufacturer's installation instructions. For NEMA 4, 4X, 6, 6P installations, the cover screws are recommended to be tightened to 15 in-lbs minimum and the trip rod locking screw tightened to 5 in-lbs minimum to properly seal the enclosure.

Typical Electrical Connections

Fig 12



Ordering Information

Model	Description	Stock No.
OSYSU-1	Outside Screw & Yoke Supervisory Switch (Single switch)	1010102
OSYSU-2	Outside Screw & Yoke Supervisory Switch (Double switch)	1010202
OSYSU-2 CRH	Outside Screw & Yoke Supervisory Switch (Double Switch). Corrosion resistant hardware of 316 stainless steel	1010210
	Cover Screw	5490424
	Hex Key for Cover Screws and Installation Adjustments	5250062
	Optional Cover Tamper Switch Kit	0090200

Engineering Specifications: OS&Y Valves

UL, CUL Listed / FM Approved and CE Marked valve supervisory switches shall be furnished and installed on all OS&Y type valves that can be used to shut off the flow of water to any portion of the fire sprinkler system, where indicated on the drawings and plans and as required by applicable local and national codes and standards. The supervisory switch shall be NEMA 4X and 6P rated and capable of being mounted in any position indoors or out and be completely submerged without allowing water to enter the enclosure.. The enclosure shall be held captive by tamper resistant screws. The device shall contain two ½" conduit entrances and one or two Single Pole Double Throw (SPDT) switches. There shall be a visual indicator to display the status of the switches. To aid in installation, it shall be possible to make fine adjustments to the position of the switch on the valve without loosening the mounting bracket from the valve. The device shall contain an adjustable length trip rod and roller, the trip rod shall be held captive by a set screw accessible upon removal of the cover. The switch contacts shall be rated at 10A, 125/250VAC and 2A, 30VDC. OS&Y Valve supervisory switch shall be model OSYSU-1 for the single switch model and OSYSU-2 for the two switch model manufactured by Potter Electric Signal Company LLC

NOTICE

Supervisory switches have a normal service life of 10-15 years. However, the service life may be significantly reduced by local environmental conditions.

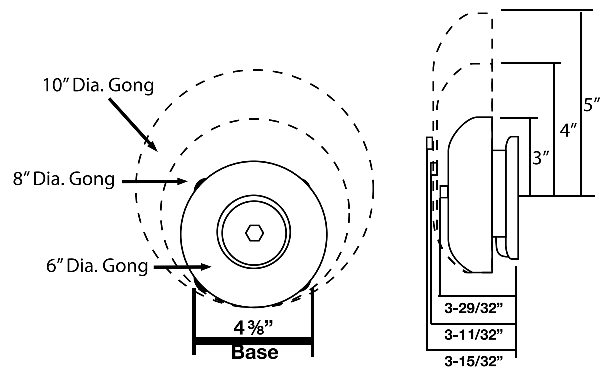
ELECTRIC ALARM BELL

LANSDALE® VALVE MANUFACTURING CORP.

LISTED AUDIBLE-SIGNAL APPLIANCES FILE# S35937

DESCRIPTION:

- 120 VAC: 6”, 8”, 10”
- 24 DC: 6”, 8”, 10”
- Four wire, 120 and 24 volt
- Specify voltage when ordering
- Indoor and outdoor Installation

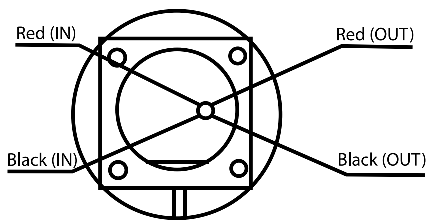


VOLTAGE 24 VAC					
6” GONG SIZE - LV-AB0624		8” GONG SIZE - LV-AB0824		10” GONG SIZE - LV-AB1024	
RATED CURRENT	SOUND LEVEL AT 1 METER	RATED CURRENT	SOUND LEVEL AT 1 METER	RATED CURRENT	SOUND LEVEL AT 1 METER
100mA	95dB	100mA	95dB	100mA	95dB

VOLTAGE 120 VAC					
6” GONG SIZE - AB-12006		8” GONG SIZE - AB-12008		10” GONG SIZE - AB-12010	
RATED CURRENT	SOUND LEVEL AT 1 METER	RATED CURRENT	SOUND LEVEL AT 1 METER	RATED CURRENT	SOUND LEVEL AT 1 METER
46mA	95dB	46mA	95dB	46mA	95dB

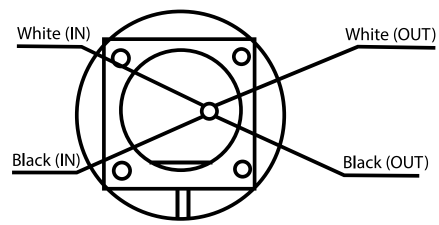
WIRING INSTRUCTIONS

D.C. BELLS (observe polarity)



When electrical supervisor is required use in and out leads as shown.
1. Observe polarity to ring DC Bells
2. Red wires positive(+)
3. Black wires negative (–)

A.C. BELLS



When electrical supervisor is required use in and out leads as shown.
1. When using AC bells, terminate each extra wire separately after last bell.
2. End-of-line resistor is not required on AC Bells

PROJECT	APPROVAL STAMP
PROJECT:	☐ APPROVED
ADDRESS:	☐ APPROVED AS NOTED
ENGINEER:	☐ NOT APPROVED
SUBMITTAL DATA:	REMARKS:
NOTES 1:	
NOTES 2:	

SECTION 6

Fire Sprinklers

tyco®

Worldwide Contacts | www.tyco-fire.com

Series LFII Residential 4.9 K-factor Concealed Pendent Sprinkler Flat Plate, Wet Pipe System

IMPORTANT

Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp446

General Description

The TYCO Series LFII Residential 4.9K Concealed Pendent Sprinklers (TY2534) are decorative, glass bulb sprinklers, available in both ordinary 155°F (68°C) and intermediate 200°F (93°C) temperature rated configurations. They are designed for use in residential occupancies such as homes, apartments, dormitories, and hotels.

The cover plate assembly conceals the sprinkler operating components above the ceiling. The flat profile of the cover plate provides the optimum aesthetically appealing sprinkler design. In addition, the concealed design of the Series LFII Residential Concealed Pendent Sprinklers provides 3/4 in. (19,1 mm) vertical adjustment. This adjustment provides a measure of flexibility when cutting fixed sprinkler drops.

The Series LFII Residential Concealed Pendent Sprinklers are intended for use in the following scenarios:

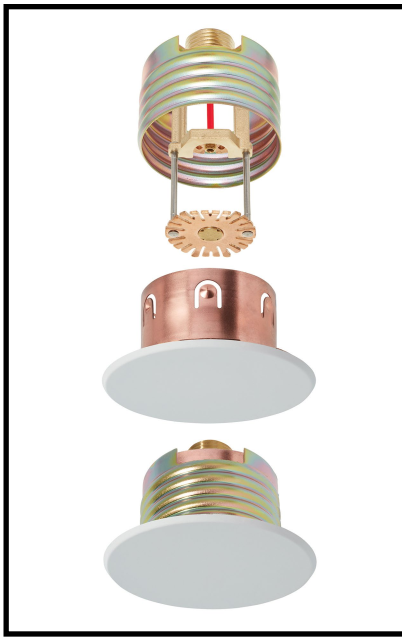
- Wet pipe residential sprinkler systems for one and two family dwellings and mobile homes per NFPA 13D
- Wet pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R
- Wet pipe sprinkler systems for the residential portions of any occupancy per NFPA 13

The Series LFII Residential Concealed Pendent Sprinklers have been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.

The Series LFII Residential Concealed Pendent Sprinklers (TY2534) are shipped with a disposable protective cap. The protective cap is temporarily removed for installation, and then it can be replaced to help protect the sprinkler while the ceiling is being installed or finished. The tip of the protective cap can also be used to mark the center of the ceiling hole into the plaster board, ceiling tiles, or other covering material, by gently pushing the ceiling product against the protective cap. When the ceiling installation is complete the protective cap is removed and the cover plate assembly is installed.

NOTICE

The Series LFII Residential Concealed Pendent Sprinklers (TY2534) described herein must be installed and maintained in compliance with this document and with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION (NFPA), in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.



The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

Sprinkler Identification Number (SIN)

TY2534

Technical Data

Approvals
UL and C-UL Listed
Australian WaterMark Certified

The TYCO Series LFII Residential Concealed Pendent Sprinklers are Listed only when installed with LFII Concealed Cover Plates having factory-applied finishes.

Note: *Sprinklers and cover plates are separately ordered. For more information, see the Ordering Procedure section.*

Maximum Working Pressure
175 psi (12,1 bar)

Maximum Coverage Area [1] ft x ft (m x m)	Maximum Spacing ft (m)	Temperature Rating	WET PIPE SYSTEM Minimum Flow and Residual Pressure [2, 3]				
			Flow gpm (Lpm)	Pressure psi (bar)	Deflector-to-Ceiling Distance	Installation Type	Minimum Spacing ft (m)
12 x 12 (3,7 x 3,7)	12 (3,7)	155°F (68°C), 200°F (93°C)	13 (49,2)	7.0 (0,48)	Smooth Ceilings 9/16 in. to 1-5/16 in. (14,3 mm to 33,3 mm) Beamed Ceilings per NFPA 13D or 13R, or 13. Installed in beam 9/16 in. to 1-5/16 in. (14,3 mm to 33,3 mm) below bottom of beam	Concealed	8 (2,4)
14 x 14 (4,3 x 4,3)	14 (4,3)		13 (49,2)	7.0 (0,48)			
16 x 16 (4,9 x 4,9)	16 (4,9)		13 (49,2)	7.0 (0,48)			
18 x 18 (5,5 x 5,5)	18 (5,5)		17 (64,3)	12.0 (0,83)			
20 x 20 (6,1 x 6,1)	20 (6,1)		20 (75,7)	16.7 (1,15)			

Notes:
1. For coverage area dimensions less than or between those indicated, use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.
2. Requirement is based on minimum flow in gpm (Lpm) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. See Hydraulic Design under the Design Criteria section.
3. For NFPA 13 residential applications, the greater of 0.1 gpm/ft² over the design area or the flow in accordance with the criteria in this table must be used.

TABLE A
WET PIPE SYSTEM
SERIES LFII RESIDENTIAL 4.9 K-FACTOR FLAT PLATE CONCEALED PENDENT SPRINKLER (TY2534)
NFPA 13D, 13R, AND 13 HYDRAULIC DESIGN CRITERIA

Discharge Coefficient

K=4.9 gpm/psi$^{1/2}$ (70,6 Lpm/bar$^{1/2}$)

Temperature Rating

Ordinary
155°F (68°C) Sprinkler
139°F (59°C) Cover Plate

Note: *Maximum Ambient Ceiling Temperature for the ordinary temperature configuration is 100°F (38°C).*

Intermediate
200°F (93°C) Sprinkler
165°F (74°C) Cover Plate

Note: *Maximum Ambient Ceiling Temperature for the intermediate temperature configuration is 150°F (65°C).*

Vertical Adjustment

3/4 in. (19,1 mm)

Finishes

See the Ordering Procedure section

Physical Characteristics

Frame . . . . Brass
Support Cup . . . . Plated Steel
Guide Pins . . . . Stainless Steel
Deflector . . . . Bronze
Compression Screw . . . . Brass
Bulb . . . . Glass
Button . . . . Phosphor Bronze
Sealing Assembly . . Beryllium Nickel w/TEFLON
Cover Plate . . . . Brass
Retainer . . . . Plated Steel
Cover Plate Ejection Spring . . . . Stainless Steel
Bridge . . . . Bronze

Operation

When exposed to heat from a fire, the cover plate, normally soldered to the retainer at three points, falls away to expose the sprinkler/support cup assembly.

The deflector, supported by the guide pins, then drops down to its operated position.

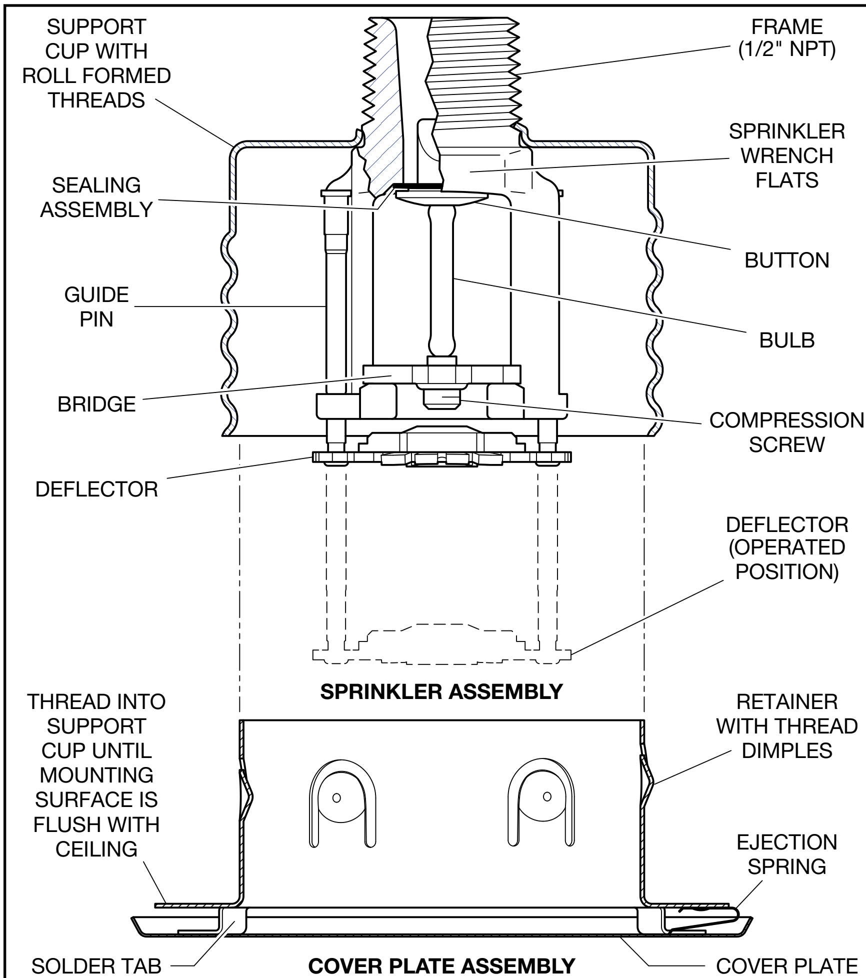


FIGURE 1
SERIES LFII RESIDENTIAL
CONCEALED PENDENT SPRINKLER (TY2534)

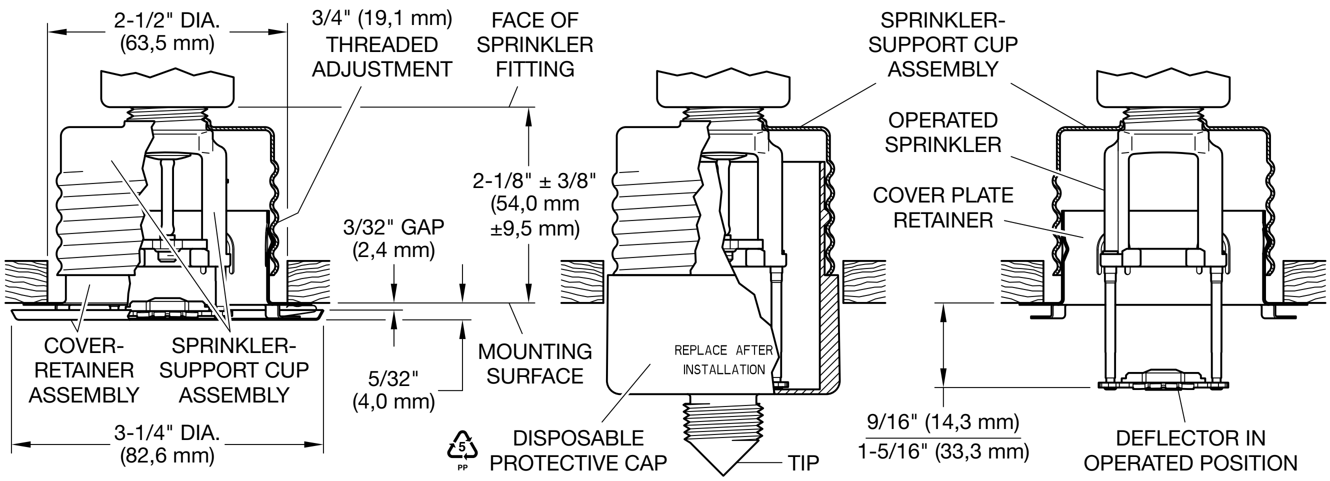


FIGURE 2
SERIES LFII RESIDENTIAL CONCEALED PENDENT SPRINKLER (TY2534)
INSTALLATION DIMENSIONS, PROTECTIVE CAP, AND ACTIVATED DEFLECTOR

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, activating the sprinkler and allowing water to flow.

Design Criteria

The TYCO Series LFII Residential Concealed Pendent Sprinklers (TY2534) are UL and C-UL Listed for installation in accordance with this section.

Note: *When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the authority having jurisdiction.*

Ceiling Types
Smooth flat horizontal, beamed, or sloped in accordance with NFPA 13D, 13R, or 13 as applicable.

Hydraulic Design (NFPA 13D and 13R)
For systems designed to NFPA 13D or NFPA 13R, the minimum required sprinkler flow rates are given in Table A as a function of temperature rating and the maximum allowable coverage areas.

The sprinkler flow rate is the minimum required discharge from each of the total number of design sprinklers as specified in NFPA 13D or NFPA 13R.

Hydraulic Design (NFPA 13)
For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- Flow rates given in Table A as a function of temperature rating and the maximum allowable coverage area
- Minimum discharge of 0.1 gpm/ft^2 over the design area comprised of the four most hydraulically demanding sprinklers for actual coverage areas protected by the four sprinklers

Obstruction to Water Distribution
Sprinklers are to be located in accordance with the obstruction rules of NFPA 13D, 13R, and 13 as applicable for residential sprinklers as well as with the obstruction criteria described within the Technical Data Sheet TFP490.

Operational Sensitivity
The sprinklers are to be installed relative to the ceiling mounting surface as shown in Figure 2.

Sprinkler Spacing
The minimum spacing between sprinklers is 8 ft (2,4 m). The maximum spacing between sprinklers cannot exceed the length of the coverage area (see Table A) being hydraulically calculated, for example, maximum 12 ft (3,7 m) for a 12 ft x 12 ft (3,7 m x 3,7 m) coverage area, or 20 ft (6,1 m) for a 20 ft x 20 ft (6,1 m x 6,1 m) coverage area.

The Series LFII must not be used in applications where the air pressure above the ceiling is greater than that below. Down drafts through the support cup could delay sprinkler operation in a fire situation.

Installation

NOTICE

The sprinkler must be installed in neutral or negative pressure plenums only.

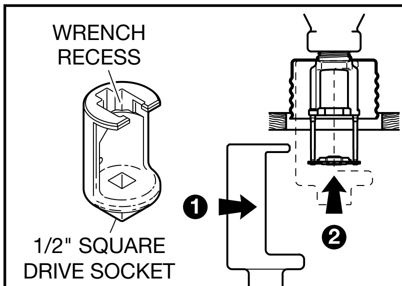


FIGURE 3
W-TYPE 44
SPRINKLER WRENCH

The TYCO Series LFII Residential Concealed Pendent Sprinklers (TY2534) must be installed in accordance with this section.

General Instructions
Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present.

A 1/2 in. NPT sprinkler joint should be obtained with a minimum to maximum torque of 7 lb-ft to 14 lb-ft (9,5 N·m to 19,0 N·m). Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the cover plate assembly by under-or over-tightening the sprinkler. Readjust the position of the sprinkler fitting to suit.

Step 1. The sprinkler must only be installed in the pendent position and with the centerline of the sprinkler perpendicular to the mounting surface.

Step 2. Remove the protective cap.

Step 3. With pipe thread sealant

applied to the pipe threads and using the W-Type 44 Wrench shown in Figure 3, position the wrench recess to first straddle the deflector guide pins from the side and then push the wrench into the support cup to engage the sprinkler wrench flats. Rotate clockwise to tighten the sprinkler-support cup assembly into the fitting. The W-Type 44 Wrench will accept a 1/2 in. ratchet drive.

Note: *Do not engage the sprinkler frame arms by the wrench, engage only the sprinkler wrench flats.*

Step 4. Replace the protective cap by pushing it upwards until it bottoms out against the support cup. The protective cap helps prevent damage to the deflector and guide pins during ceiling installation and during application of the finish coating of the ceiling. It may also be used to locate the center of the clearance hole by gently pushing the ceiling material against the center point of the cap.

Note: *As long as the protective cap remains in place, the system is considered to be OUT OF SERVICE.*

Step 5. After the ceiling has been completed with the 2 1/2 in. (63 mm) diameter clearance hole and in preparation for installing the cover plate assembly, remove and discard the protective cap, and verify that the deflector moves up and down freely.

If the sprinkler has been damaged and the deflector does not move up and down freely, replace the entire sprinkler assembly. Do not attempt to modify or repair a damaged sprinkler.

Step 6. Push on the cover plate assembly until its flange comes in contact with the ceiling.

Do not continue to push on the cover plate assembly such that it lifts a ceiling panel out of its normal position.

If the cover plate assembly cannot be engaged with the mounting cup or the cover plate assembly cannot be engaged sufficiently to contact the ceiling, the sprinkler fitting must be repositioned.

Care and Maintenance

The TYCO Series LFII Residential Concealed Pendent Sprinklers (TY2534) must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system which it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Absence of a cover plate may delay the sprinkler operation in a fire situation.

When properly installed, there is an air gap between the lip of the cover plate and the ceiling. The cover plate assembly has a nominal 3/32 in. (2,4 mm) air gap, as shown in Figure 2. This air gap is necessary for proper operation of the sprinkler by allowing heat flow from a fire to pass below and above the cover plate to help assure appropriate release of the cover plate in a fire situation. If the ceiling is to be repainted after the installation of the sprinkler, care must be exercised to ensure that the new paint does not seal off any of the air gap.

Factory painted cover plates must not be repainted. They should be replaced, if necessary, by factory painted units. Non-factory applied paint may adversely delay or prevent sprinkler operation in the event of a fire.

Do not pull the cover plate relative to the enclosure. Separation may result.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified or over heated sprinklers must be replaced.

Care must be exercised to avoid damage before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION such as NFPA 25, in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

The owner must assure that the sprinklers are not used for hanging any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.

Automatic sprinkler systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and part number (P/N).

Sprinkler Assemblies
Specify: Series LFII (TY2534) 4.9K Residential Concealed Pendent Sprinkler, P/N (specify):

155°F (68°C)	51-549-1-155
200°F (93°C)	51-549-1-200

Note: *Sprinkler and Cover Plates are separately sold. See below for Cover Plate ordering information.*

Cover Plate Assemblies
Specify: LFII Concealed Sprinkler Cover Plate Assembly, temperature rating (specify), finish (specify), P/N (specify):

139°F (59°C)

Ivory (RAL1015)	56-891-0-135
Bright Chrome	56-891-9-135B
Beige (RAL1001)	56-891-2-135
Pure White (RAL9010)*	56-891-3-135
Signal White (RAL9003)**	56-891-4-135
Grey White (RAL9002)	56-891-5-135
Brown (RAL8028)	56-891-6-135
Black (RAL9005)	56-891-7-135
Brushed Brass	56-891-8-135
Brushed Chrome	56-891-9-135
Custom Paint	56-891-X-135

165°F (74°C)

Ivory (RAL1015)	56-891-0-165
Bright Chrome	56-891-9-165B
Beige (RAL1001)	56-891-2-165
Pure White (RAL9010)*	56-891-3-165
Signal White (RAL9003)**	56-891-4-165
Grey White (RAL9002)	56-891-5-165
Brown (RAL8028)	58-891-6-165
Black (RAL9005)	56-891-7-165
Brushed Brass	56-891-8-165
Brushed Chrome	56-891-9-165
Custom Paint	56-891-X-165

* Eastern Hemisphere sales only
** Previously known as Bright White

Note: *All custom cover plates are painted using SHERWIN-WILLIAMS Interior Latex Paint. Contact Johnson Controls Customer Service with any questions related to custom orders.*

Sprinkler Wrench
Specify: W-Type 44 Sprinkler Wrench, P/N 56-000-1-077

Johnson Controls

Series RFII — 5.6 K-factor "Royal Flush II" Concealed Pendent Sprinklers Quick & Standard Response, Standard Coverage

IMPORTANT
Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp181

General Description

The TYCO Series RFII 5.6 K-factor, "Royal Flush II" Concealed Pendent Sprinklers Quick Response (3-mm bulb) and Standard Response (5-mm bulb), are decorative sprinklers featuring a flat cover plate designed to conceal the sprinkler. These sprinklers are optimal for architecturally sensitive areas such as hotel lobbies, office buildings, churches, and restaurants.

Each sprinkler includes a cover plate/retainer assembly and a sprinkler/support cup assembly. The separable, two-piece assembly design provides the following benefits:

- Allows installation of the sprinklers and pressure testing of the fire protection system prior to installation of a suspended ceiling or application of the finish coating to a fixed ceiling.
- Permits the removal of suspended ceiling panels for access to building service equipment without having to first shut down the fire protection system and remove sprinklers.
- Provides for 1/2 in. (12,7 mm) of vertical adjustment to allow a measure of flexibility in determining the length of fixed piping to cut for the sprinkler drops.

The Series RFII Sprinklers are shipped with a disposable protective cap. The protective cap is temporarily removed during installation and replaced to help protect the sprinkler during ceiling installation or finish. The tip of the protective cap can be used to mark the center of the ceiling hole into plaster board or ceiling tiles by gently pushing the ceiling product against the protective cap. When ceiling installation is complete, the protective cap is removed and the cover plate/retainer assembly is installed.

As an option, the Series RFII Standard Response (5-mm bulb) "Royal Flush II" Concealed Pendent Sprinklers can be fitted with a silicone air and dust seal as shown in Figure 5. The air and dustsseal is intended for sensitive areas where it is desirable to prevent air and dust from the area above the ceiling to pass through the cover plate.

NOTICE

The Series RFII Concealed Pendent Sprinklers described herein must be installed and maintained in compliance with this document and with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION (NFPA), in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Sprinkler Identification Number (SIN)

TY3531 — 3 mm bulb
TY3551 — 5 mm bulb

Technical Data

Sprinkler Approvals
Approvals apply only to the service conditions indicated in the Design Criteria section.

- TY3531 (3 mm Bulb) is UL Listed, C-UL Listed and NYC Approved (MEA 353-01-E) as Quick Response.
- TY3531 (3 mm Bulb) is EAC Approved and VdS Approved (Certificate No. G4090007).
- TY3531 (3 mm Bulb) is FM and LPCB Approved (Ref. No. 094a/10) as Standard Response.

  Note: *FM and LPCB do not approve concealed sprinklers for quick response.*
- TY3551 (5 mm Bulb) is UL Listed, C-UL Listed, EAC Approved, FM Approved, LPCB Approved (Ref. No. 094a/9), and NYC Approved (MEA 353-01-E) as Standard Response.

Approvals for Air and Dust Seal
UL and C-UL Listed for use with the RFII Standard Response Concealed Sprinkler (TY3551)

Maximum Working Pressure
Maximum 250 psi (17,3 bar) by UL, C-UL, and NYC

Maximum 175 psi (12,1 bar) by FM, VdS, and LPCB

Temperature Rating
155°F (68°C) Sprinkler with 139°F (59°C) Cover Plate

200°F (93°C) Sprinkler with 165°F (74°C) Cover Plate

Discharge Coefficient
K= 5.6 GPM/psi$^{1/2}$ (80,6 LPM/bar$^{1/2}$)

Adjustment
1/2 in. (12,7 mm)

Finishes
See the Ordering Procedure section.

Physical Characteristics

Frame	Bronze
Support Cup	Plated Steel
Guide Pins	Stainless Steel
Deflector	Bronze
Compression Screw	Brass
Bulb	Glass
Cap	Bronze or Copper
Sealing Assembly	Beryllium Nickel w/TEFLON
Cover Plate	Brass
Retainer	Brass
Ejection Spring	Stainless Steel

Design Criteria

The TYCO Series RFII 5.6 K-factor, “Royal Flush II” Concealed Pendent Sprinklers are intended for fire protection systems designed in accordance with the standard installation rules recognized by the applicable Listing or Approval agency; for example, UL Listing is based on NFPA 13 and VdS Approval is based on the CEA 4001.

For more information on LPCB and VdS Approvals, contact Johnson Controls at the following office:

Enschede, Netherlands
Telephone: 31-53-428-4444
Fax: 31-53-428-3377

The Series RFII Concealed Pendent Sprinklers are only listed and approved with the Series RFII Concealed Cover Plates having a factory applied finish.

NOTICE

Do not use the Series RFII in applications where the air pressure above the ceiling is greater than that below. Down drafts through the sprinkler/support cup assembly can delay sprinkler operation in a fire situation.

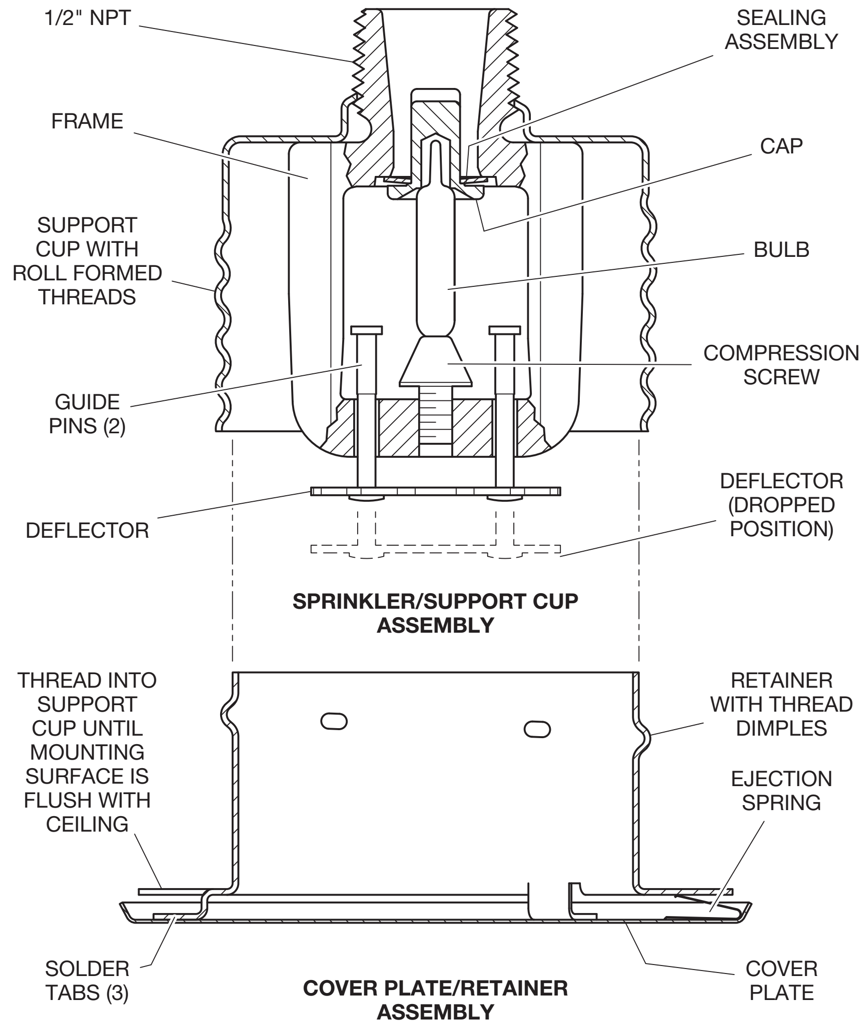


FIGURE 1
MODEL RFII CONCEALED SPRINKLER ASSEMBLY

Operation

When exposed to heat from a fire, the cover plate, normally soldered to the retainer at three points, falls away to expose the sprinkler/support cup assembly.

The deflector — supported by the guide pins — then drops down to its operational position.

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, activating the sprinkler and allowing water to flow.

Installation

The TYCO Series RFII 5.6 K-factor, “Royal Flush II” Concealed Pendent Sprinklers must be installed in accordance with this section.

General Instructions
Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 in. (1,6 mm) for the 155°F (68°C) and 3/32 in. (2,4 mm) for the 200°F (93°C) temperature ratings.

A leak-tight 1/2 in. NPT sprinkler joint should be obtained by applying a minimum to maximum torque of 7 ft-lb to 14 ft-lb (9,5 N·m to 19,0 N·m). Higher levels of torque can distort the sprinkler Inlet with consequent leakage or impairment of the sprinkler.

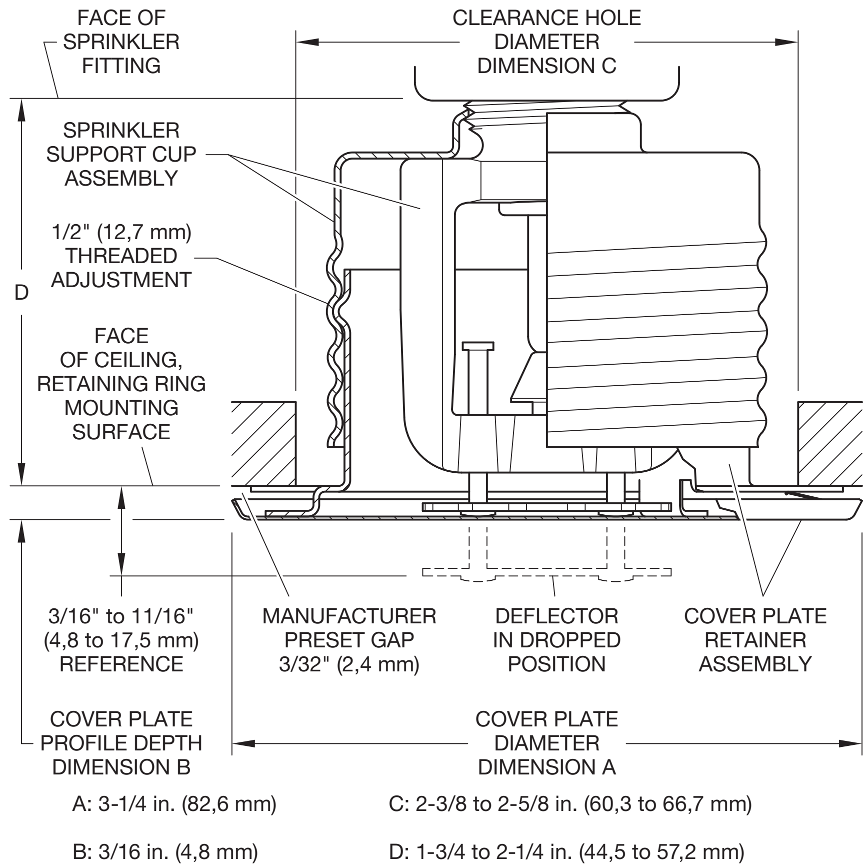


FIGURE 2
SERIES CONCEALED SPRINKLER INSTALLATION DIMENSIONS

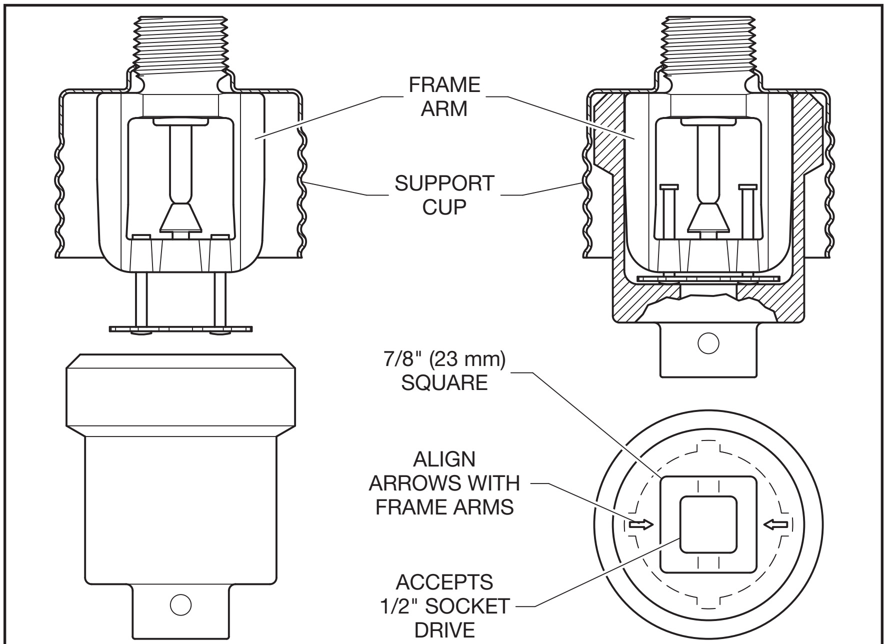


FIGURE 3
RFII SPRINKLER WRENCH

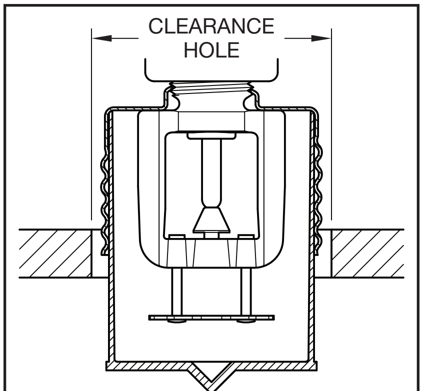


FIGURE 4
DISPOSABLE PROTECTIVE CAP

Do not attempt to compensate for insufficient adjustment in the sprinkler by under- or over-tightening the sprinkler/support cup assembly. Re-adjust the position of the sprinkler fitting to suit.

Step 1. Install the sprinkler only in the pendent position with the center-line of the sprinkler perpendicular to the mounting surface.

Step 2. Remove the protective cap.

Step 3. With pipe thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step 4. Wrench-tighten the sprinkler using only the RFII Sprinkler Wrench. as shown in Figure 3. Apply the wrench to the sprinkler as shown in Figure 3.

Step 5. Replace the protective cap by pushing it upwards until it bottoms out against the support cup as shown in Figure 4. The protective cap helps prevent damage to the deflector and arms during ceiling installation and/or finish. You can also use the protective cap to locate the center of the clearance hole by gently pushing the ceiling material up against the center point of the protective cap.

NOTICE

As long as the protective cap remains in place, the system is considered "Out of Service".

Step 6. After the ceiling has been completed with the 2-1/2 in. (63,5 mm) diameter clearance hole and in preparation for installing the cover plate/retainer assembly, remove and discard the protective cap. Verify that the deflector moves up and down freely.

If the sprinkler is damaged and the deflector does not move up and down freely, replace the entire sprinkler. Do not attempt to modify or repair a damaged sprinkler.

Step 7. When installing an air and dust Seal, see Figure 5 for reference and

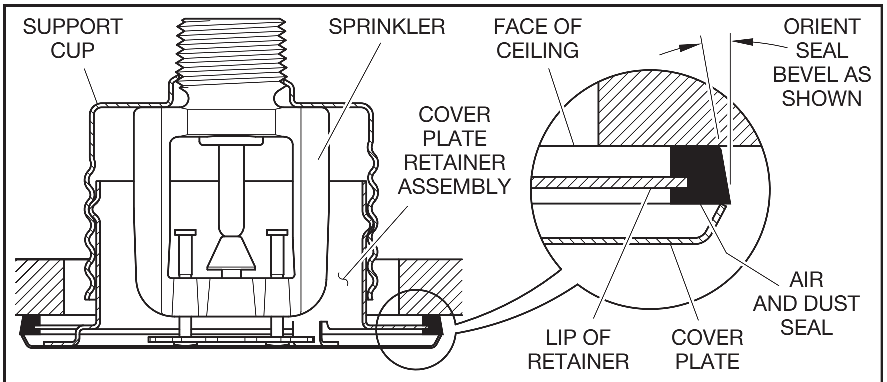


FIGURE 5
OPTIONAL AIR AND DUST SEAL FOR SERIES RFII (TY3551)

follow this step; otherwise, proceed to Step 8. To attach the air and dust seal, verify the angle of the outside edge of the seal is oriented according to Figure 5. Start the edge of the retainer in the grooved slot of the air and dust seal and continue around the retainer until the entire air and dust seal is engaged.

Step 8. Screw on the cover plate/retainer assembly until the retainer, shown in Figure 2, or the air and dust seal, shown in Figure 5, contacts the ceiling. Do not continue to screw on the cover plate/retainer assembly so that it lifts a ceiling panel out of its normal position. If you cannot engage the cover plate/retainer assembly with the support cup or you cannot engage the cover plate/retainer assembly sufficiently to contact the ceiling, you must reposition the sprinkler fitting.

Care and Maintenance

The TYCO Series RFII 5.6 K-factor, “Royal Flush II” Concealed Pendent Sprinklers must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection system from the proper authorities and notify all personnel who may be affected by this action.

Absence of the cover plate/retainer assembly can delay sprinkler operation in a fire situation.

When properly installed, there is a nominal 3/32 in. (2,4 mm) air gap between the lip of the cover plate and the ceiling, as shown in Figure 2.

This air gap is necessary for proper operation of the sprinkler. If the ceiling requires repainting after sprinkler installation, ensure that the new paint does not seal off any of the air gap.

Do not pull the cover plate relative to the enclosure. separation may result.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. For information about replacing a sprinkler, see the Installation Section.

Exercise care to avoid damage to sprinklers before, during, and after installation. Replace sprinklers damaged by dropping, striking, wrench twisting, wrench slipping, or the like. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. For information about replacing a sprinkler, see the Installation section.

If you must remove a sprinkler, do not reinstall it or a replacement without reinstalling the cover plate/retainer assembly. If a cover plate/retainer assembly becomes dislodged during service, replace it immediately.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION such as NFPA 25, in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or sprinkler manufacturer regarding any questions.

Automatic sprinkler systems should be inspected, tested, and maintained by a qualified inspection service in accordance with local requirements and/or national code.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name.

Sprinkler/Support Cup Assembly

Specify: Series RFII (specify SIN), K=5.6, “Royal Flush II” Pendent Sprinklers (specify) temperature rating, P/N* (specify):

	155°F (68°C)	200°F (93°C)
TY3531	51-792-1-155	51-792-1-200
TY3551	51-790-1-155	51-790-1-200

* Use Suffix “I” for ISO 7-1 connection; for example, 51-792-1-155-I

Separately Ordered Cover Plate/ Retainer Assembly:

Specify: (temperature rating from below) Series RFII Concealed Cover Plate with (finish), P/N (specify).

	139°F (59°C)(a)	165°F (74°C)(b)
Grey White (RAL9002)	56-792-0-135	56-792-0-165
Brushed Brass	56-792-1-135	56-792-1-165
Brass	56-792-2-135	56-792-2-165
Pure White (c) (RAL9010)	56-792-3-135	56-792-3-165
Signal White (RAL9003)	56-792-4-135	56-792-4-165
Jet Black (RAL9005)	56-792-6-135	56-792-6-165
Terra Brown (RAL8028)	56-792-7-135	56-792-7-165
Brushed Chrome	56-792-8-135	56-792-8-165
Chrome	56-792-9-135	56-792-9-165
Custom	56-792-X-135	56-792-X-165

NOTES
a. For use with 155°F (68°C) sprinklers.
b. For use with 200°F (93°C) sprinklers.
c. Eastern Hemisphere sales only.

Sprinkler Wrench

Specify: RFII Sprinkler Wrench, P/N 56-000-1-075

Air and Dust Seal

Specify: Air and Dust Seal, P/N 56-908-1-001

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Series TY-FRB, 5.6 K-factor Upright, Pendent, and Recessed Pendent Sprinklers Quick Response, Standard Coverage

IMPORTANT

Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp172

General Description

The TYCO Series TY-FRB, 5.6 K-factor, Upright (TY313) and Pendent (TY323) Sprinklers described in this data sheet are quick response, standard coverage, decorative 3 mm glass bulb-type spray sprinklers designed for use in light or ordinary hazard, commercial occupancies such as banks, hotels, and shopping malls.

The recessed version of the Series TY-FRB Pendent Sprinkler, where applicable, is intended for use in areas with a finished ceiling. This recessed pendent sprinkler uses one of the following:

- A two-piece Style 15 Recessed Escutcheon with recessed adjustment up to 5/8 in. (15,9 mm) from the flush pendent position.
- A two-piece Style 20 Recessed Escutcheon with recessed adjustment up to 1/2 in. (12,7 mm) from the flush pendent position.

The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the fixed pipe drops to the sprinklers must be cut.

Intermediate level versions of Series TY-FRB Sprinklers are described in Technical Data Sheet TFP357. Sprinkler guards and shields are described in Technical Data Sheet TFP780.

NOTICE

The TYCO Series TY-FRB Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the performance of these devices.

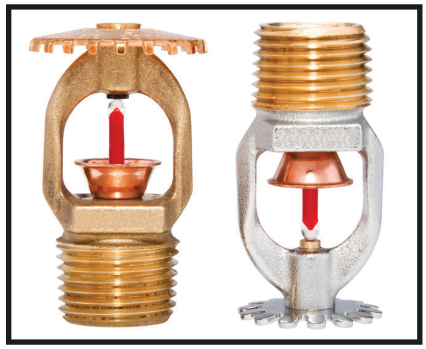
The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

Sprinkler Identification Number (SIN)

TY313 . . . . Upright 5.6K, 1/2 in. NPT
TY323 . . . . Pendent 5.6K, 1/2 in. NPT

Technical Data

Approvals
See Table A



Maximum Working Pressure
175 psi (12.1 bar)
250 psi (17.2 bar)*

* The maximum working pressure of 250 psi (17.2 bar) only applies to the listing by Underwriters Laboratories, Inc. (UL).

Discharge Coefficient
K=5.6 GPM/psi$^{1/2}$ (80,6 LPM/bar$^{1/2}$)

Temperature Rating
See Table A

Finishes
Sprinkler: See Table B

Recessed Escutcheon: White Coated, Black Coated, Chrome Plated, or Brass Plated

Physical Characteristics

Frame	Bronze
Button	Brass/Copper
Sealing Assembly	Stainless Steel w/TEFLON
Bulb	Glass
Compression Screw	Bronze
Deflector	Bronze

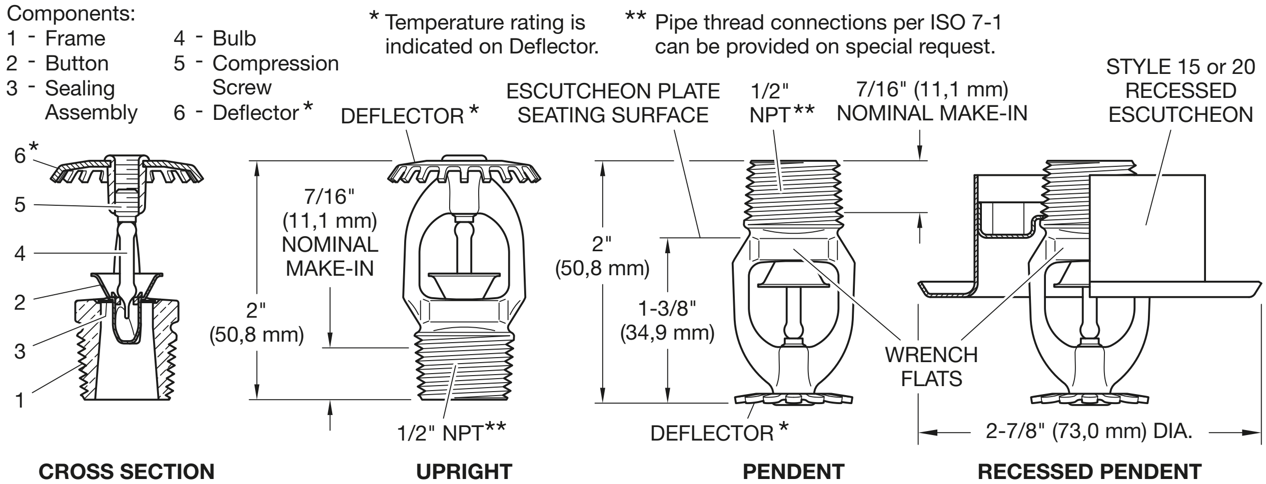


FIGURE 1
SERIES TY-FRB UPRIGHT (TY313) AND PENDENT (TY323) SPRINKLERS
5.6 K-FACTOR, 1/2 INCH NPT, QUICK RESPONSE

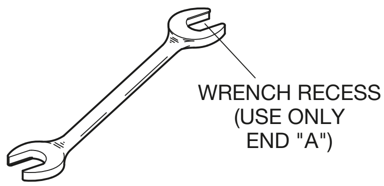


FIGURE 2
W-TYPE 6
SPRINKLER WRENCH

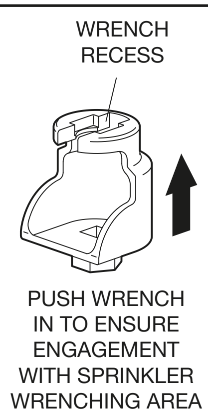


FIGURE 3
W-TYPE 7 RECESSED
SPRINKLER WRENCH

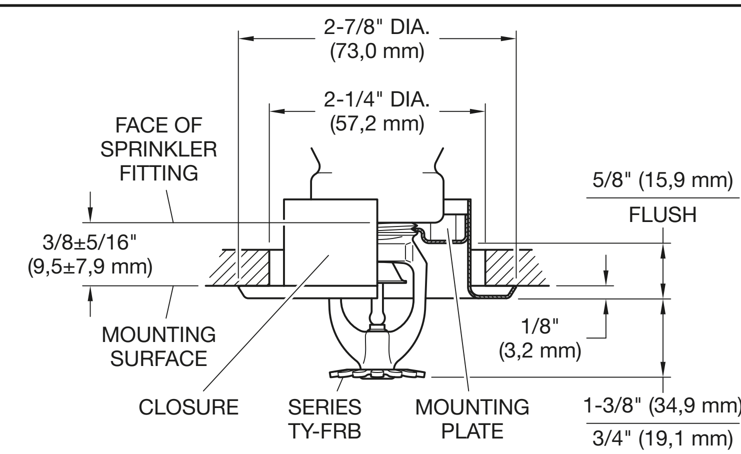


FIGURE 4
SERIES TY-FRB RECESSED PENDENT SPRINKLER ASSEMBLY (TY323)
WITH TWO PIECE 5/8 INCH TOTAL ADJUSTMENT STYLE 15
RECESSED ESCUTCHEON

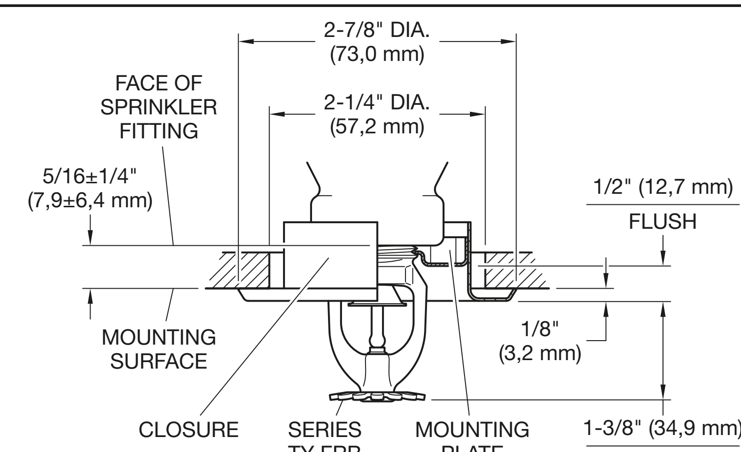


FIGURE 5
SERIES TY-FRB RECESSED PENDENT SPRINKLER ASSEMBLY (TY323)
WITH TWO PIECE 1/2 INCH TOTAL ADJUSTMENT STYLE 20
RECESSED ESCUTCHEON

K-Factor	Type	Temperature	Sprinkler Finish[8]			
			Bulb Liquid Color	Natural Brass	Chrome Plated	Polyester[c]
5.6 1/2 in. NPT	UPRIGHT (TY313) and PENDENT (TY323)	135°F (57°C)	Orange	1, 2, 3, 4, 5, 6, 7		
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			
		286°F (141°C)	Blue			
	RECESSED PENDENT (TY323) Figures 4[a] and 5[b]	135°F (57°C)	Orange	1, 2, 3, 4, 7		
		155°F (68°C)	Red			
		175°F (79°C)	Yellow			
		200°F (93°C)	Green			

Notes:
1. Listed by Underwriters Laboratories, Inc., (UL) as Quick Response Sprinklers.
2. Listed by Underwriters Laboratories, Inc., for use in Canada (C-UL) as Quick Response Sprinklers.
3. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers.
4. Approved by the City of New York under MEA 354-01-E.
5. VdS Approved (For details, contact Johnson Controls, Enschede, Netherlands, Tel. 31-53-428-4444/Fax 31-54-428-3377.)
6. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 094a/06) as Quick Response Sprinklers.
7. EAC Approved.
8. Where Polyester Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion-Resistant Sprinklers.

a. Installed with Style 15 (1/2 in. NPT) 5/8 in. Total Adjustment Recessed Escutcheon, as applicable.
b. Installed with Style 20 (1/2 in. NPT) 1/2 in. Total Adjustment Recessed Escutcheon, as applicable.
c. Frame and Deflector only. Listings and approvals apply to color (Special Order).

TABLE A
LABORATORY LISTINGS AND APPROVALS FOR 5.6 K-FACTOR SPRINKLERS

Operation

The glass bulb contains a fluid which expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, allowing the sprinkler to activate and water to flow.

Design Criteria

The TYCO Series TY-FRB, 5.6 K-factor, Upright (TY313) and Pendent (TY323) Sprinklers are intended for fire protection systems designed in accordance with the standard installation rules recognized by the applicable Listing or Approval agency (such as, UL Listing is based on the requirements of NFPA 13, and FM Approval is based on the requirements of FM's Loss Prevention Data Sheets). Only the Style 15 or Style 20 Recessed Escutcheon is to be used for recessed pendent installations.

Installation

The TYCO Series TY-FRB, 5.6 K-factor, Upright (TY313) and Pendent (TY323) Sprinklers must be installed in accordance with this section.

General Instructions
Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 in. (1,6 mm) for the 135°F (57°C) and 3/32 in. (2,4 mm) for the 286°F (141°C) temperature ratings.

A leak-tight 1/2 in. NPT sprinkler joint should be obtained by applying a minimum to maximum torque of 7 to 14 lb-ft (9,5 to 19,0 N·m). Higher levels of torque can distort the sprinkler Inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the Escutcheon Plate by under- or over-tightening the sprinkler. Re-adjust the position of the sprinkler fitting to suit.

Upright and Pendent Sprinklers
The Series TY-FRB Upright and Pendent Sprinklers must be installed in accordance with the following instructions.

Step 1. Install Pendent sprinklers in the pendent position. Install upright sprinklers in the upright position.

Step 2. With pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step 3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench as shown in Figure 2. Apply the W-Type 6 Sprinkler Wrench to the wrench flats as shown in Figure 1. Torque sprinklers 7 to 14 lb-ft (9,5 to 19,0 N·m).

Recessed Pendent Sprinklers
The Series TY-FRB Recessed Pendent Sprinklers must be installed in accordance with the following instructions.

Step A. After installing the Style 15 or Style 20 Mounting Plate over the sprinkler threads, and with pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step B. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench as shown in Figure 3. Apply the W-Type 7 Recessed Sprinkler Wrench to the sprinkler wrench flats as shown in Figure 1. Torque sprinklers 7 to 14 lb-ft (9,5 to 19,0 N·m).

Step C. After ceiling installation and finishing, slide on the Style 15 or Style 20 Closure over the Series TY-FRB Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the ceiling.

P/N[a] 77 – XXX – X – XXX

		SIN
370	5.6K UPRIGHT (1/2 in.NPT)	TY313
371	5.6K PENDENT (1/2 in.NPT)	TY323

Notes:
a. Use suffix "I" for ISO 7-1 connection; for example, 77-370-4-175-I

	SPRINKLER FINISH
1	NATURAL BRASS
3	PURE WHITE (RAL9010)[a] POLYESTER
4	SIGNAL WHITE (RAL9003) POLYESTER
5	JET BLACK (RAL9005) POLYESTER
9	CHROME PLATED

Notes:
a. Eastern Hemisphere sales only

	TEMPERATURE RATINGS
135	135°F (57°C)
155	155°F (68°C)
175	175°F (79°C)
200	200°F (93°C)
286	286°F (141°C)

TABLE B
SERIES TY-FRB UPRIGHT AND PENDENT SPRINKLERS
PART NUMBER SELECTION

Care and Maintenance

The TYCO Series TY-FRB, 5.6 K-factor, Upright (TY313) and Pendent (TY323) Sprinklers must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection systems from the proper authorities and notify all personnel who may be affected by this action.

Absence of the outer piece of an escutcheon, which is used to cover a clearance hole, can delay sprinkler operation in a fire situation.

The owner must assure that the sprinklers are not used for hanging any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section.)

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association such as NFPA 25, in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Sprinkler Assemblies with NPT Thread Connections
Specify: Series TY-FRB Upright or Pendent (specify) Sprinkler, SIN (specify), K=5.6, Quick Response, (specify) temperature rating, (specify) finish, P/N (specify, refer to Table A).

Recessed Escutcheon
Specify: Style 15 Recessed Escutcheon with (specify*) finish, P/N (specify*)

Specify: Style 20 Recessed Escutcheon with (specify*) finish, P/N (specify*)

* Refer to Technical Data Sheet TFP770

Sprinkler Wrench
Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001

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Johnson Controls

Series DS-1 Dry-Type Sprinklers 5.6K Pendent, Upright, and Horizontal Sidewall Quick Response, Standard Coverage

IMPORTANT

Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp510

General Description

TYCO Series DS-1 Dry-Type Sprinklers, 5.6K Pendent, Upright, and Horizontal Sidewall, Quick Response (3 mm bulb) and Standard Coverage are decorative glass bulb automatic sprinklers designed for commercial use. Dry-type sprinklers are typically used where:

- Pendent sprinklers are required on dry pipe systems that are exposed to freezing temperatures; for example, sprinkler drops from unheated portions of buildings
- Sprinklers and/or a portion of the connecting piping are exposed to freezing temperatures; for example, sprinkler drops from wet systems into freezers, sprinkler sprigs from wet systems into unheated attics, or horizontal piping extensions through a wall to protect an unheated areas such as loading docks, overhangs, and building exteriors
- Sprinklers are used on systems that are seasonally drained to avoid freezing for example, vacation areas

NOTICE

The Series DS-1 Dry-Type Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION (NFPA), in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

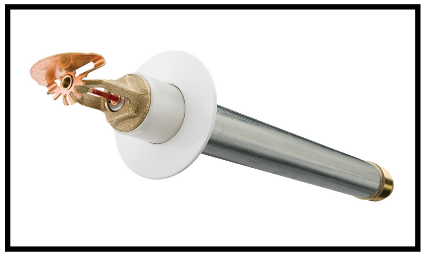
The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

The Series DS-1 Dry-Type Sprinklers must only be installed in fittings that meet the requirements of the Design Criteria section.

Sprinkler Identification Numbers (SINs)

3/4 in. NPT:
TY3935 – Pendent
TY3735 – Horizontal Sidewall

1 in. NPT:
TY3235 – Pendent
TY3135 – Upright
TY3335 – Horizontal Sidewall



Technical Data

Approvals
UL and C-UL Listed
FM Approved
LPCB Approved
CE Certified

Note: *For Approvals details, see Tables A and B.*

Maximum Working Pressure
175 psi (12,1 bar)

Inlet Thread Connections
3/4 in. NPT
1 in. NPT or ISO 7-R 1

Discharge Coefficient
K=5.6 gpm/psi$^{1/2}$ (80,6 Lpm/bar$^{1/2}$)

Temperature Ratings
See Table A and Table B

Finishes
Sprinkler and Escutcheon see Table D

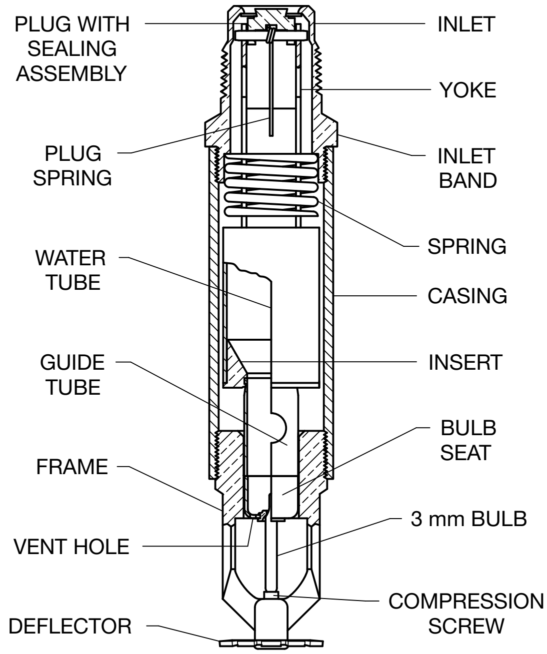


FIGURE 1
SERIES DS-1, 3/4 IN. NPT, DRY-TYPE SPRINKLER ASSEMBLY

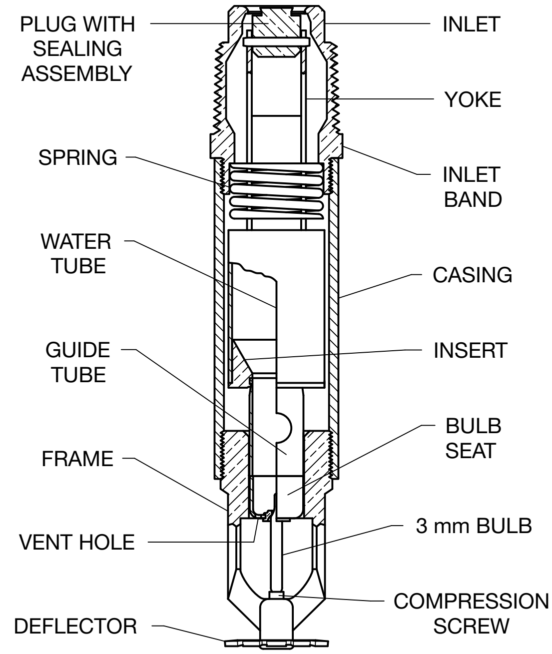


FIGURE 2
SERIES DS-1, 1 IN. NPT AND ISO 7-R 1 DRY-TYPE SPRINKLER ASSEMBLY

Physical Characteristics

Inlet	Copper
Plug	Copper
Yoke	Stainless Steel
Casing	Galvanized Carbon Steel
Insert	Bronze
Bulb Seat	Stainless Steel
Bulb	Glass
Compression Screw	Bronze
Deflector	Bronze
Frame	Bronze
Guide Tube	Stainless Steel
Water Tube	Stainless Steel
Spring	Stainless Steel
Plug Spring*	Stainless Steel
Sealing Assembly	Beryllium Nickel w/TEFLON
Escutcheon	Carbon Steel or Stainless Steel

* For 3/4 in. NPT only

Operation

When the TYCO Series DS-1 Dry-Type Sprinklers, 5.6K Pendent, Upright, and Horizontal Sidewall, Quick Response (3 mm bulb) and Standard Coverage are in service, water is prevented from entering the assembly by the plug with sealing assembly in the inlet of the sprinkler. See Figure 1 and Figure 2.

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, and the bulb seat is released.

The compressed spring is then able to expand and push the water tube as well as the guide tube outward. This action simultaneously pulls inward on the yoke, withdrawing the plug with sealing assembly from the inlet and allowing the sprinkler to activate and flow water.

Design Criteria

The TYCO Series DS-1 Dry-Type Sprinklers, 5.6K Pendent, Upright, and Horizontal Sidewall, Quick Response (3 mm bulb) and Standard Coverage are intended for use in fire sprinkler systems designed in accordance with the standard installation rules recognized by the applicable Listing or Approval agency; for example, UL Listing is based on NFPA 13 requirements.

Sprinkler Fittings
Install the 3/4 or 1 in. NPT Series DS-1 Dry-Type Sprinklers in the 3/4 or 1 in. NPT outlet or run of the following fittings:

- Malleable or ductile iron threaded tee fittings that meet the dimensional requirements of ANSI B16.3 (Class 150)
- Cast iron threaded tee fittings that meet the dimensional requirements of ANSI B16.4 (Class 125)

Do not install the DS-1 Sprinklers into an elbow fittings. The inlet of the sprinkler can contact the interior of the elbow, potentially damaging the Inlet seal.

The unused outlet of the threaded tee is plugged as shown in Figure 13.

You can also install the Series DS-1 Dry-Type Sprinklers in the 3/4 or 1 in. NPT outlet of a GRINNELL Figure 730 Mechanical Tee. However, the use of the Figure 730 Tee for this arrangement is limited to wet pipe systems.

The configuration shown in Figure 12 is only applicable for wet pipe systems where the sprinkler fitting and water-filled pipe above the sprinkler fitting are not subject to freezing and where the length of the dry-type sprinkler has the minimum exposure length depicted in Figure 11. See the Exposure Length section.

For wet pipe system installations of the 1 in. NPT Series DS-1 Dry-Type Sprinklers connected to CPVC piping, use the following CPVC fittings:

- 1 in. x 1 in. NPT female adapter
- 1 in. x 1 in. x 1 in. NPT sprinkler head adapter tee

Note: *For more information on specific CPVC fitting design and installation criteria, refer to CPVC manufacturer.*

For wet pipe system installations of the the 3/4 in. NPT Series DS-1 Sprinklers connected to CPVC piping, use in the 3/4 in. x 3/4 in. NPT female adapter.

For dry pipe system installations, use only the side outlet of maximum 2 1/2 in. reducing tee when locating the Series DS-1 Sprinklers directly below the branch line. Otherwise, use the configuration shown in Figure 13 to assure complete water drainage from above the Series DS-1 Dry-Type Sprinklers and the branch line. Failure to do so may result in pipe freezing and water damage.

<table>
<tr><th rowspan="3">Temperature Rating</th><th rowspan="3">Bulb Liquid Color</th><th colspan="9">3/4 in. NPT</th></tr>
<tr><th colspan="3">TY3935 Pendent
with Recessed Escutcheon
(Figure 4)</th><th colspan="3">TY3935 Pendent
with Standard Escutcheon
(Figure 3)
with Deep Escutcheon
(Figure 5)
without Escutcheon
(Figure 6)</th><th colspan="3">TY3735 Horizontal Sidewall
with Top of Deflector-to-Ceiling
Distance of 4 to 12 in.
(100 to 300 mm)
with Standard Escutcheon
(Figure 8)
with Deep Escutcheon
(Figure 9)
without Escutcheon
(Figure 10)</th></tr>
<tr><th colspan="9">Finish</th></tr>
<tr><th></th><th></th><th>Natural Brass</th><th>Chrome Plated</th><th>White Polyester</th><th>Natural Brass</th><th>Chrome Plated</th><th>White Polyester</th><th>Natural Brass</th><th>Chrome Plated</th><th>White Polyester</th></tr>
<tr><td>155°F (68°C)</td><td>Red</td><td colspan="3" rowspan="4">1, 2</td><td colspan="3" rowspan="4">1, 2</td><td colspan="3" rowspan="4">1*, 2*</td></tr>
<tr><td>175°F (79°C)</td><td>Yellow</td></tr>
<tr><td>200°F (93°C)</td><td>Green</td></tr>
<tr><td>286°F (141°C)</td><td>Blue</td></tr>
</table>

NOTES
1. Listed by Underwriters Laboratories, Inc. (maximum order length of 48 in.)
2. Listed by Underwriters Laboratories for use in Canada (maximum order length of 48 in.)

* Light and Ordinary Hazard occupancies only

TABLE A
3/4 IN. NPT SERIES DS-1 QUICK RESPONSE, STANDARD COVERAGE DRY-TYPE SPRINKLERS LABORATORY LISTINGS AND APPROVALS

<table>
<tr><th rowspan="3">Temperature Rating</th><th rowspan="3">Bulb Liquid Color</th><th colspan="9">1 in. NPT (and ISO 7-R 1)</th></tr>
<tr><th colspan="3">TY3235 Pendent
with Recessed Escutcheon
(Figure 4)</th><th colspan="3">TY3235 Pendent
with Standard Escutcheon
(Figure 3)
with Deep Escutcheon
(Figure 5)
without Escutcheon
(Figure 6)
TY3135 Upright
without Escutcheon[4]
(Figure 7)</th><th colspan="3">TY3335 Horizontal Sidewall
with Top of Deflector-to-Ceiling
Distance of 4 to 12 in.
(100 to 300 mm)
with Standard Escutcheon
(Figure 8)
with Deep Escutcheon
(Figure 9)
without Escutcheon
(Figure 10)</th></tr>
<tr><th colspan="9">Finish</th></tr>
<tr><th></th><th></th><th>Natural Brass</th><th>Chrome Plated</th><th>White Polyester</th><th>Natural Brass</th><th>Chrome Plated</th><th>White Polyester</th><th>Natural Brass</th><th>Chrome Plated</th><th>White Polyester</th></tr>
<tr><td>155°F (68°C)</td><td>Red</td><td colspan="2">1, 2, 3, 5, 6</td><td>1, 2, 5, 6</td><td colspan="2">1, 2, 3, 5, 6</td><td>1, 2, 5, 6</td><td colspan="2">1*, 2*, 3**, 5*, 6*</td><td>1*, 2*, 5*, 6*</td></tr>
<tr><td>175°F (79°C)</td><td>Yellow</td><td colspan="2">1, 2, 3</td><td>1, 2</td><td colspan="2">1, 2, 3</td><td>1, 2</td><td colspan="2">1*, 2*, 3**</td><td>1*, 2*</td></tr>
<tr><td>200°F (93°C)</td><td>Green</td><td colspan="2">1, 2, 3, 5, 6</td><td>1, 2, 5, 6</td><td colspan="2" rowspan="2">1, 2, 3, 5, 6</td><td rowspan="2">1, 2, 5, 6</td><td colspan="2" rowspan="2">1*, 2*, 3**, 5*, 6*</td><td rowspan="2">1*, 2*, 5*, 6*</td></tr>
<tr><td>286°F (141°C)</td><td>Blue</td><td colspan="3">1, 2</td></tr>
</table>

NOTES
1. Listed by Underwriters Laboratories, Inc. (maximum order length of 48 in.)
2. Listed by Underwriters Laboratories for use in Canada (maximum order length of 48 in.)
3. Approved by Factory Mutual Research Corporation (maximum order length of48 in.)
4. The Upright Sprinkler without an Escutcheon (TY3135) is available in 1 in. NPT only
5. Loss Prevention Certification Board (LPCB)
6. CE Certified

* Light and Ordinary Hazard occupancies only
** Light Hazard occupancies only

TABLE B
1 IN. NPT (AND ISO 7-R 1) SERIES DS-1 QUICK RESPONSE, STANDARD COVERAGE DRY-TYPE SPRINKLERS LABORATORY LISTINGS AND APPROVALS

NOTICE

Do not install the Series DS-1 Dry-Type Sprinkler into any other type fitting. Failure to use the appropriate fitting may result in one of the following:

- *Failure of the sprinkler to operate properly due to formation of ice over the inlet plug or binding of the inlet plug*
- *Insufficient engagement of the Inlet pipe threads with consequent leakage*

Drainage
In accordance with the minimum requirements of the NATIONAL FIRE PROTECTION ASSOCIATION for dry pipe sprinkler systems, branch, cross, and feed-main piping connected to dry sprinklers and subject to freezing temperatures must be pitched for proper drainage.

Exposure Length
When using dry sprinklers in wet pipe sprinkler systems to protect areas subject to freezing temperatures, use Table C to determine a sprinkler's appropriate exposed barrel length to prevent water from freezing in the connecting pipes due to conduction. The exposed barrel length measurement must be taken from the face of the sprinkler fitting to the surface of the structure or insulation that is exposed to the heated area. For example, see Figure 11.

Clearance Space
In accordance with NFPA 13, when connecting an area subject to freezing and an area containing a wet pipe sprinkler system, the clearance space around the sprinkler barrel of dry-type sprinklers must be sealed. Due to tem-

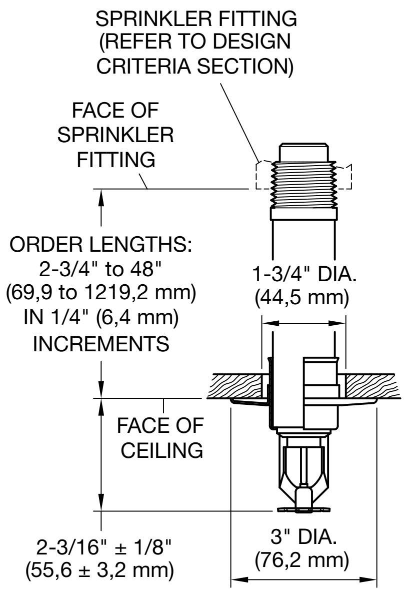


FIGURE 3
PENDENT TY3235 AND TY3935 WITH STANDARD ESCUTCHEON

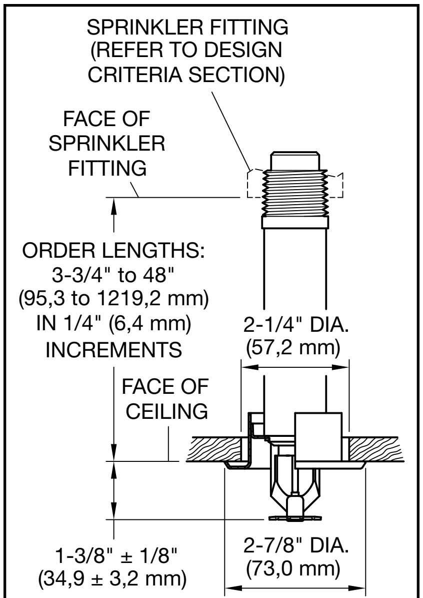


FIGURE 4
PENDENT TY3235 AND TY3935 WITH RECESSED ESCUTCHEON

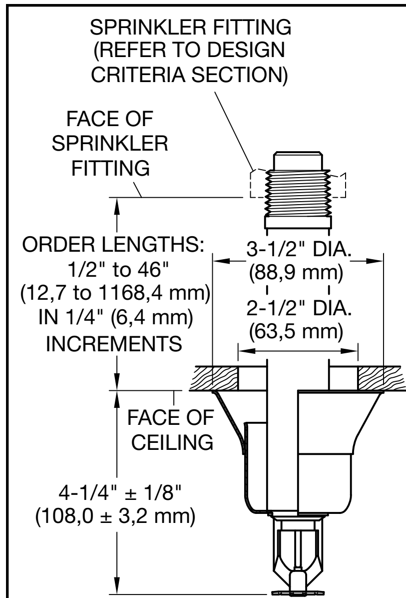


FIGURE 5
PENDENT TY3235 AND TY3935 WITH DEEP ESCUTCHEON

perature differences between two areas, the potential for the formation of condensation in the sprinkler and subsequent ice build-up is increased. If this condensation is not controlled, ice build-up can occur that might damage the dry-type sprinkler and/or prevent proper operation in a fire situation.

Model DSB-2 Dry Sprinkler Boot (Technical Data Sheet TFP591), as shown in Figure 14 and Figure 15, can provide the recommended seal.

Installation

The TYCO Series DS-1 Dry-Type Sprinklers, 5.6K Pendent, Upright, and Horizontal Sidewall, Quick Response (3 mm bulb) and Standard Coverage must be installed in accordance with this section.

General Instructions
The Series DS-1 Dry-Type Sprinklers must only be installed in fittings that meet the requirements of the Design Criteria section. See the Design Criteria section for other important requirements regarding piping design and sealing of the clearance space around the sprinkler casing.

Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 in. (1,6 mm) for the 155°F (68°C) rating to 1/8 in. (3,2 mm) for the 286°F (141°C) rating.

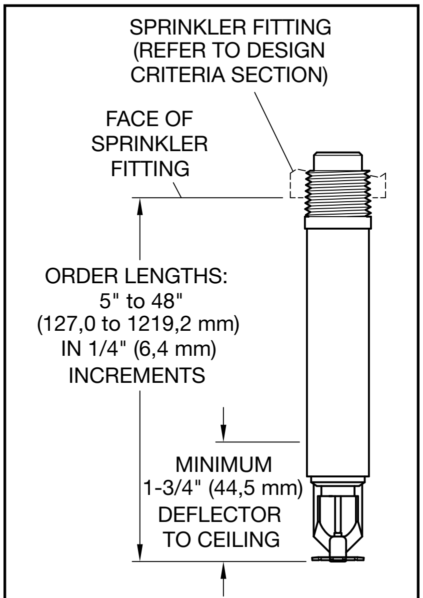


FIGURE 6
PENDENT TY3235 AND TY3935 WITHOUT ESCUTCHEON

- A leak-tight 3/4 in. NPT sprinkler joint should be obtained by applying a minimum-to-maximum torque of 10 ft-lb to 20 ft-lb (13,4 N·m to 26,8 N·m).
- A leak-tight 1 in. NPT sprinkler joint should be obtained by applying a minimum-to-maximum torque of 20 ft-lb to 30 ft-lb (26,8 N·m to 40,2 N·m).

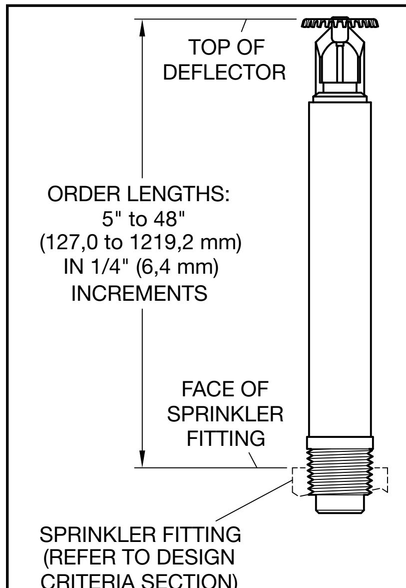


FIGURE 7
UPRIGHT TY3135 WITHOUT ESCUTCHEON, 1 IN. NPT ONLY

Higher levels of torque can distort the sprinkler Inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in an escutcheon plate by under or over-tightening the sprinkler. Re-adjust the position of the sprinkler fitting to suit.

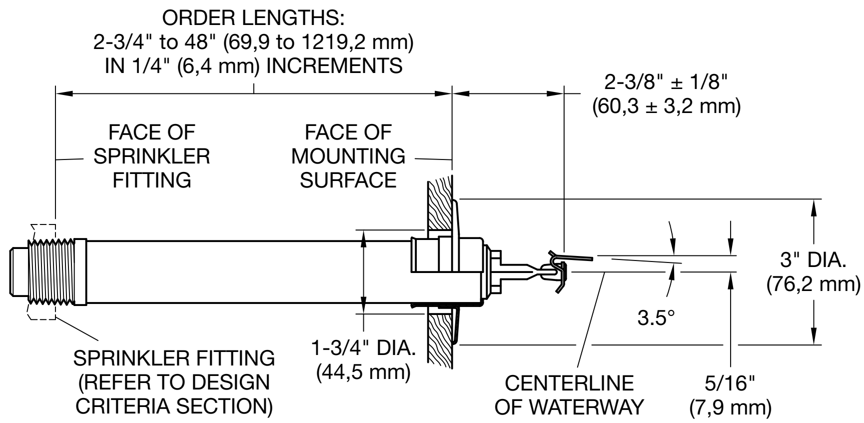


FIGURE 8
TY3335 AND TY3735 HORIZONAL SIDEWALL
WITH STANDARD ESCUTCHEON

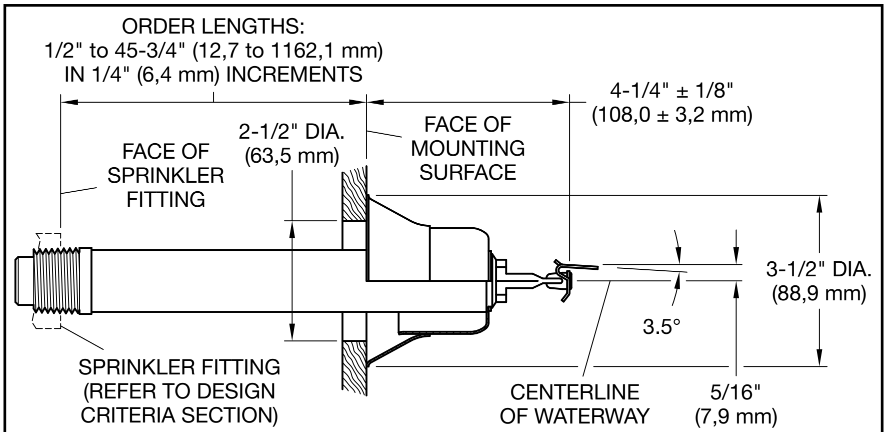


FIGURE 9
TY3335 AND TY3735 HORIZONAL SIDEWALL
WITH DEEP ESCUTCHEON

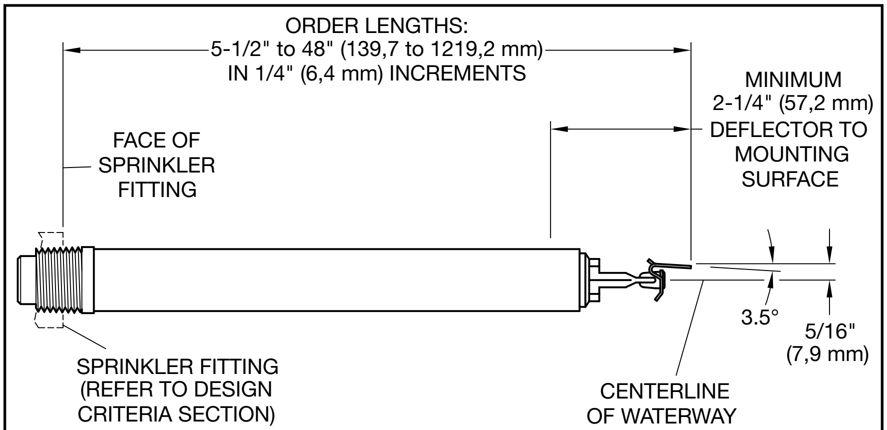


FIGURE 10
TY3335 AND TY3735 HORIZONAL SIDEWALL
WITHOUT ESCUTCHEON

Step 1. Install pendent sprinklers only in the pendent position, and install upright sprinklers only in the upright position. The deflector of a pendent or upright sprinkler must be parallel to the ceiling.

Install horizontal sidewall sprinklers in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. Ensure the word “TOP” on the deflector faces the ceiling.

Step 2. With a non-hardening pipe-thread sealant such as TEFLON tape applied to the inlet threads, hand-tighten the sprinkler into the sprinkler fitting.

Step 3. Wrench-tighten the sprinkler using either of the following tools:

- Pipe wrench on the inlet band or the casing, see Figures 1 and 2
- W-Type 7 Sprinkler Wrench on the wrench flat, see Figure 16

Apply the wrench recess of the W-Type 7 Sprinkler Wrench to the wrench flat.

Note: *If sprinkler removal becomes necessary, remove the sprinkler using the same wrenching method noted above. Sprinkler removal is easier when a non-hardening sealant was used and torque guidelines were followed. After removal, inspect the sprinkler for damage.*

Step 4. After installing the ceiling or wall and applying a ceiling finish, slide on the outer piece of the escutcheon until it comes in contact with the ceiling or wall. Do not lift the ceiling panel out of its normal position.

When using the deep escutcheon, hold the outer piece in contact with the mounting surface (ceiling or wall). Then rotate the inner piece approximately 1/4 turn with respect to the outer piece, to hold the deep escutcheon firmly together.

Ambient Temperature Exposed to Discharge End of Sprinkler	Temperatures for Heated Area(1)		
	40°F (4°C)	50°F (10°C)	60°F (16°C)
	Minimum Exposed Barrel Length(2), in. (mm)		
40°F (4°C)	0	0	0
30°F (-1°C)	0	0	0
20°F (-7°C)	4 (100)	0	0
10°F (-12°C)	8 (200)	1 (25)	0
0°F (-18°C)	12 (305)	3 (75)	0
-10°F (-23°C)	14 (355)	4 (100)	1 (25)
-20°F (-29°C)	14 (355)	6 (150)	3 (75)
-30°F (-34°C)	16 (405)	8 (200)	4 (100)
-40°F (-40°C)	18 (455)	8 (200)	4 (100)
-50°F (-46°C)	20 (510)	10 (255)	6 (150)
-60°F (-51°C)	20 (510)	10 (255)	6 (150)

Notes:
1. For protected area temperatures that occur between values listed above, use the next cooler temperature.
2. These lengths are inclusive of wind velocities up to 30 mph (18,6 kph).

TABLE C
EXPOSED SPRINKLER BARRELS IN WET PIPE SYSTEMS MINIMUM RECOMMENDED LENGTHS

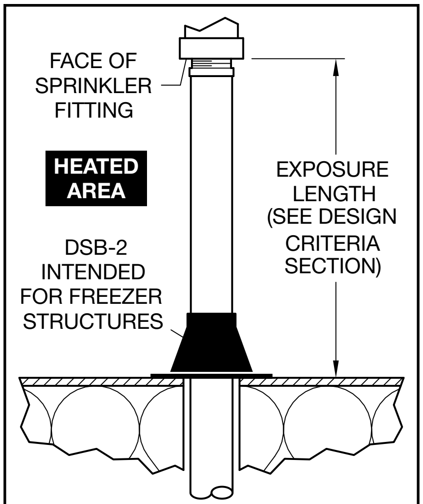


FIGURE 11
EXPOSURE LENGTH

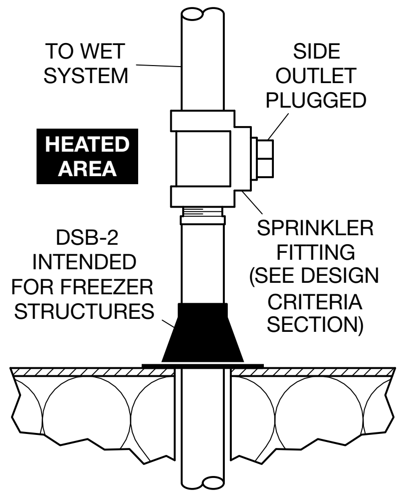


FIGURE 12
SPRINKLER FITTING UNHEATED AREA

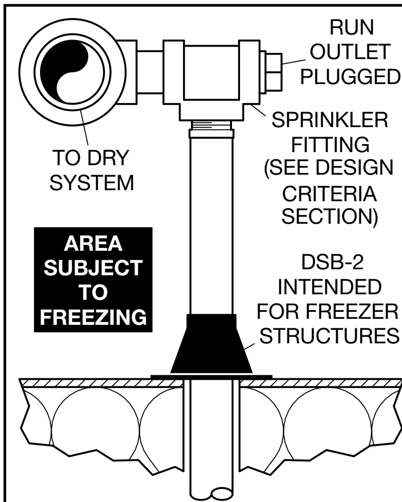


FIGURE 13
SPRINKLER FITTING HEATED AREA

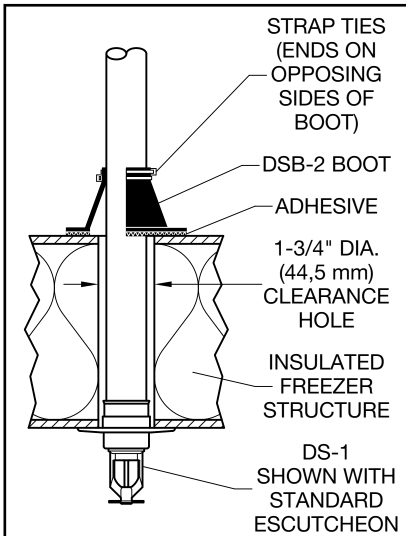


FIGURE 14
MODEL DSB-2 DRY SPRINKLER BOOT WITH PENDENT SERIES DS-1 DRY-TYPE SPRINKLER

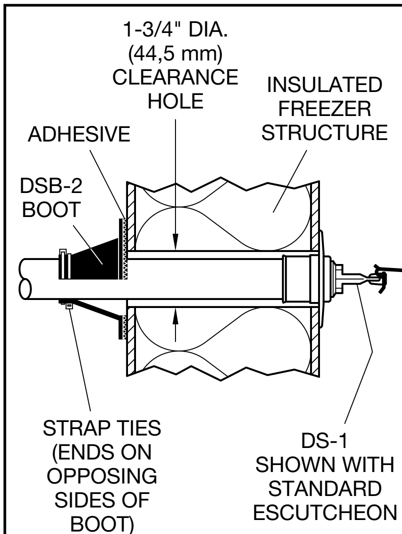


FIGURE 15
MODEL DSB-2 DRY SPRINKLER BOOT WITH SIDEWALL SERIES DS-1 DRY-TYPE SPRINKLER

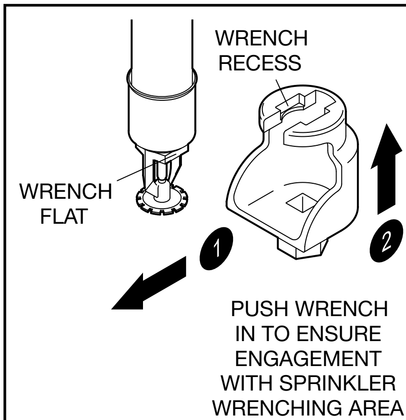


FIGURE 16
W-TYPE 7 SPRINKLER WRENCH

Care and Maintenance

The TYCO Series DS-1 Dry-Type Sprinklers, 5.6K Pendent, Upright, and Horizontal Sidewall, Quick Response (3 mm bulb) and Standard Coverage must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection systems from the proper authorities and notify all personnel who may be affected by this action.

Absence of the outer piece of an escutcheon, which is used to cover a clearance hole, can delay the time to sprinkler operation in a fire situation.

A vent hole is provided in the bulb seat (see Figures 1 and 2) to indicate if the dry-type sprinkler is remaining dry. Evidence of leakage from the vent hole indicates potential leakage past the Inlet seal and the need to remove the sprinkler to determine the cause of leakage for example, an improper installation or an ice plug. Close the fire protection system control valve and drain the system before removing the sprinkler.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. See the Installation Section.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION such as NFPA 25, in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

DS-1 Dry-Type Sprinklers
When ordering TYCO Series DS-1 Dry-Type Sprinklers, 5.6K Pendent, Upright, and Horizontal Sidewall, Quick Response (3 mm bulb) and Standard Coverage, specify the following information:

- SIN:
  Pendent – TY3935 or TY3235
  Sidewall – TY3735 or TY3335
  Upright – TY3135
- 5.6 K-factor
- Deflector style: Upright, Pendent, or Horizontal Sidewall
- Quick Response, Standard Coverage, Dry-Type Sprinkler
- Order length: Dry-Type Sprinklers are furnished based upon order length as measured acording to Figures 3 through 10. After taking the measurement, round it to the nearest 1/4 in. increment.
- Inlet connections: 3/4 in. NPT, 1 in. NPT, or ISO 7-R 1
- Temperature rating
- Sprinkler finish
- Escutcheon style and finish, as applicable
- Part Number (P/N) from Table D

  The upright sprinkler without an escutcheon (TY3135) is available in 1 in. NPT only.

  Part Numbers are for 3/4 in. and 1 in. NPT standard order sprinklers. Orders for all other sprinkler assemblies must be accompanied by a complete description. Refer to the price list for a complete listing of part numbers.

Replacement Escutcheons
Order replacement escutcheons separately.

Note: *Style 10 recessed escutcheons are shipped as assemblies comprised of closure ring and mounting plate. The included mounting plate is not used for dry type sprinkler applications, discard accordingly.*

Specify: (specify type), (specify) finish, P/N (specify):

Recessed (Style 10)	
Brass Plated	56-701-2-010
Signal White (RAL9003)	56-701-4-010
Chrome Plated	56-701-9-010
Standard (Push-On)	
White Color	91-106-0-007
Brass Plated	91-106-2-007
Chrome Plated	91-106-9-007
Deep	
Brass Plated	91-107-2-010
White	91-107-4-007
Chrome Plated	91-107-9-007

Sprinkler Wrench
Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001

Model DSB-2 Dry Sprinkler Boot
Model DSB-2 Dry Sprinkler Boot includes one boot, two strap ties, and 1/3 oz of adhesive, quantity of adhesive is sufficient for one boot installation.

Specify: Model DSB-2 Dry Sprinkler Boot, P/N 63-000-0-002

P/N* 60 – XXX – X – XXX

		SIN
01	Pendent with Standard Escutcheon (3/4 in. NPT)	TY3935 (Figure 3)
02	Pendent with Deep Escutcheon (3/4 in. NPT)	TY3935 (Figure 5)
03	Pendent with Recessed Escutcheon (3/4 in. NPT)	TY3935 (Figure 4)
04	Pendent without Escutcheon (3/4 in. NPT)	TY3935 (Figure 6)
05	Sidewall with Standard Escutcheon (3/4 in. NPT)	TY3735 (Figure 8)
06	Sidewall with Deep Escutcheon (3/4 in. NPT)	TY3735 (Figure 9)
07	Sidewall without Escutcheon (3/4 in. NPT)	TY3735 (Figure 10)
36	Pendent with Standard Escutcheon (1 in. NPT)	TY3235 (Figure 3)
33	Pendent with Deep Escutcheon (1 in. NPT)	TY3235 (Figure 5)
37	Pendent with Recessed Escutcheon (1 in. NPT)	TY3235 (Figure 4)
32	Pendent without Escutcheon (1 in. NPT)	TY3235 (Figure 6)
34	Sidewall with Standard Escutcheon (1 in. NPT)	TY3335 (Figure 8)
43	Sidewall with Deep Escutcheon (1 in. NPT)	TY3335 (Figure 9)
44	Sidewall without Escutcheon (1 in. NPT)	TY3335 (Figure 10)
38	Upright without Escutcheon (1 in. NPT)	TY3135 (Figure 7)

	Sprinkler Finish	Escutcheon Finish[1]
0	Chrome Plated	Signal White (RAL9003) Polyester
1	Natural Brass	Signal White (RAL9003) Polyester
2	Natural Brass	Brass Plated
4	Signal White (RAL9003) Polyester	Signal White (RAL9003) Polyester
8	Chrome Plated	Stainless Steel
9	Chrome Plated	Chrome Plated

	Sample Order Length[2]
055	5.50 in.
082	8.25 in.
180	18.00 in.
187	18.75 in.
372	37.25 in.
480	48.00 in.

	Temperature Rating
1	155°F (68°C)
2	175°F (79°C)

	Temperature Rating
3	200°F (93°C)
4	286°F (141°C)

NOTES
1. Escutcheon Finish applies to sprinklers provided with escutcheons.
2. Dry-Type Sprinklers are furnished based upon “Order Length” as measured per Figures 3 through 10, as applicable, and for each individual sprinkler where it is to be installed. After the measurement is taken, round it to the nearest 1/4 in. increment.

* Use Prefix “I” for ISO 7-R 1 Connection (for example, I-60-360-4-055).

TABLE D
SERIES DS-1 DRY-TYPE SPRINKLERS
PART NUMBER SELECTION

1467 Elmwood Avenue, Cranston, RI 02910 | Telephone +1-401-781-8220

Series RFII-C — 5.6 K-factor Special Application Royal Flush II Quick Response Concealed Pendent Sprinklers for Corridors and Hallways

IMPORTANT

Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp263

General Description

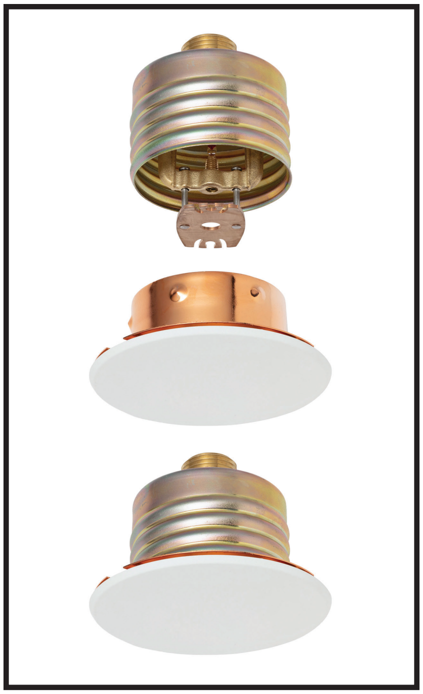
The TYCO Series RFII-C, 5.6 K-factor Special Application Royal Flush II Quick Response Concealed Pendent Sprinklers for corridors and hallways of light hazard occupancies are decorative, 3 mm bulb-type sprinklers featuring a flat cover plate designed to conceal the sprinkler. These sprinklers are specifically designed for use in long, narrow spaces such as corridors or hallways with a maximum coverage area of 28 ft by 10 ft (8,5 m x 3,1 m). Fewer sprinklers and lower system pressure demands are required as compared to the traditional extended coverage sprinklers.

The Series RFII-C sprinklers are intended for use in automatic sprinkler systems designed in accordance with standard installation rules such as NFPA 13. The fast-response thermal sensitivity rating of the Series RFII-C sprinkler provides for a Quick Response, Extended Coverage (QREC) rating up to a 28 ft x 10 ft (8,5 m x 3,1 m) maximum coverage area.

Each sprinkler includes a cover plate/retainer assembly and a sprinkler/support cup assembly. The separable, two-piece assembly design provides the following benefits:

- Allows installation of the sprinklers and pressure testing of the fire protection system prior to installation of a suspended ceiling or application of the finish coating to a fixed ceiling.
- Permits the removal of suspended ceiling panels for access to building service equipment without having to first shut down the fire protection system and remove sprinklers.
- Provides for 1/2 in. (12,7 mm) of vertical adjustment to allow a measure of flexibility in determining the length of fixed piping to cut for the sprinkler drops.

The Series RFII-C sprinklers are shipped with a disposable protective cap. The protective cap is temporarily removed during installation and replaced to help protect the sprinkler during ceiling installation or finish. The tip of the protective cap can be used to mark the center of the ceiling hole into plaster board or ceiling tiles by gently pushing the ceiling product against the protective cap. When ceiling installation is complete, the protective cap is removed and the cover plate/retainer assembly is installed.



NOTICE

The TYCO Series RFII-C, 5.6 K-factor Special Application Royal Flush II Quick Response Concealed Pendent Sprinklers described herein must be installed and maintained in compliance with this document and with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION (NFPA), in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

Sprinkler Identification Number (SIN)

TY3582

Technical Data

Approvals
UL Listed

Maximum Working Pressure
250 psi (17,2 bar)

Discharge Coefficient
K = 5.6 gpm/psi$^{1/2}$ (80 Lpm/bar$^{1/2}$)

Temperature Rating
155°F (68°C) Sprinkler; 139°F (59°C) Plate

200°F (93°C) Sprinkler; 165°F (74°C) Plate

Adjustment
1/2 in. (12,7 mm)

Finishes
See the Ordering Procedure section

Physical Characteristics

Frame	Bronze
Support Cup	Plated Steel
Guide Pins	Stainless Steel
Deflector	Brass
Compression Screw	Brass
Bulb	Glass
Cap	Bronze or Copper
Sealing Assembly	Beryllium Nickel w/TEFLON
Cover Plate	Brass
Retainer	Brass
Ejection Spring	Stainless Steel

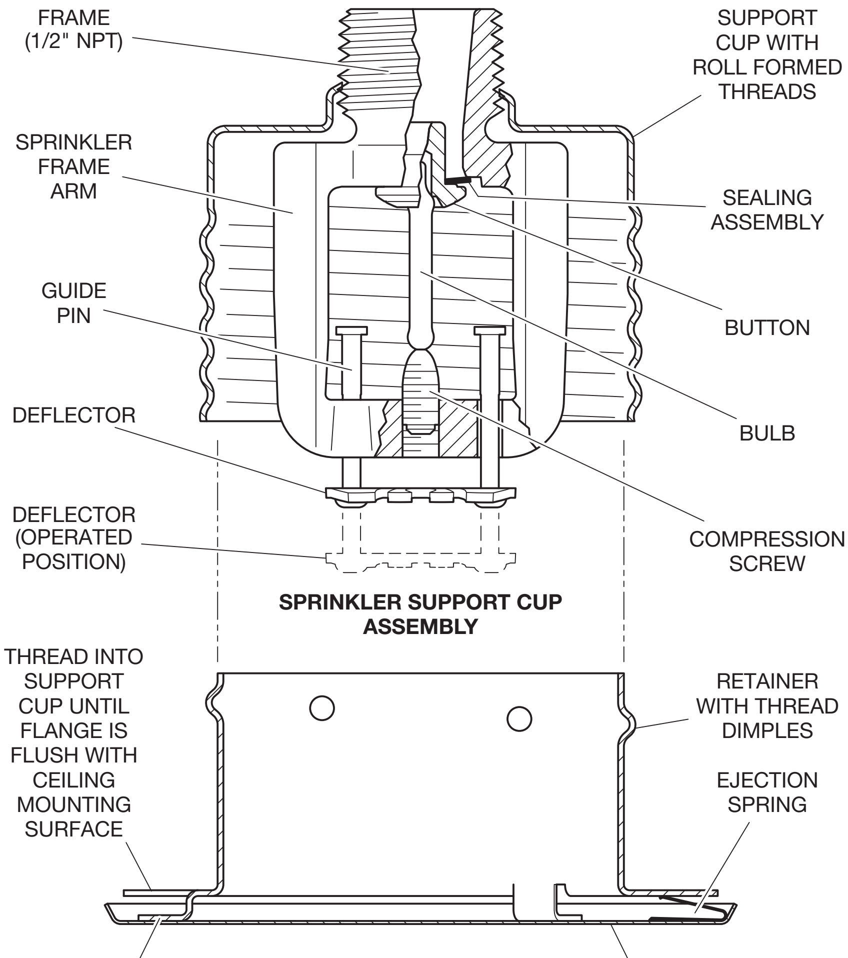


FIGURE 1
SERIES RFII-C SPRINKLER

Description	Coverage Area	Flow Rate	Pressure
TY3582 (K=5.6) Concealed Sprinkler	28 ft x 8 ft (8,5 m x 2,4 m)	23 gpm (87,1 Lpm)	16.9 psi (1,2 bar)
	28 ft x 10 ft (8,5 m x 3,1 m)	28 gpm (106 Lpm)	25 psi (1,7 bar)

Note: For coverage area dimensions less than or between those listed, use the minimum flow required for the next highest coverage area.

TABLE A
SERIES RFII-C (TY3582)
FLOW CRITERIA FOR UL LISTING

Design Criteria

The TYCO Series RFII-C, 5.6 K-factor Special Application Royal Flush II Quick Response Concealed Pendent Sprinklers are UL Listed for use in light hazard occupancies, using the design criteria in Table A and UL requirements in this section, in addition to the requirements specified in NFPA 13 for extended coverage pendent sprinklers.

UL Listing Requirements

1. The Series RFII-C sprinklers may be used for the coverage areas shown in Table A, based on maintaining the minimum specified flow rate as a function of coverage area for all of the sprinklers in the design area.

2. With respect to heat sensitivity, the Series RFII-C sprinklers can be used with unobstructed construction consisting of flat, smooth ceilings (including bar joists) with a maximum pitch of one in six as defined and permitted by NFPA 13.

3. The minimum allowable spacing between the Series RFII-C sprinklers, to prevent cold soldering, is 12 ft (3,7 m) in the 28 ft (8,5 m) long spray direction.

4. The Series RFII-C sprinklers must not be installed with the short spray direction, 8 ft (2,4 m) or 10 ft (3,1 m), oriented towards another Series RFII-C sprinkler or a Series EC-8C pendent sprinkler's short spray direction. For more information, see Figure 3.

5. The Series RFII-C sprinklers must be installed in accordance with all other requirements of NFPA 13 for extended coverage pendent sprinklers.

Note: *The Series RFII-C sprinklers are only listed and approved with the Series RFII concealed cover plates with a factory-applied finish.*

NOTICE

Do not use the TYCO Series RFII-C, 5.6 K-factor Special Application Royal Flush II Quick Response Concealed Pendent Sprinklers in applications where the air pressure above the ceiling is greater than that below. Down drafts through the sprinkler/support cup assembly can delay sprinkler operation in a fire situation.

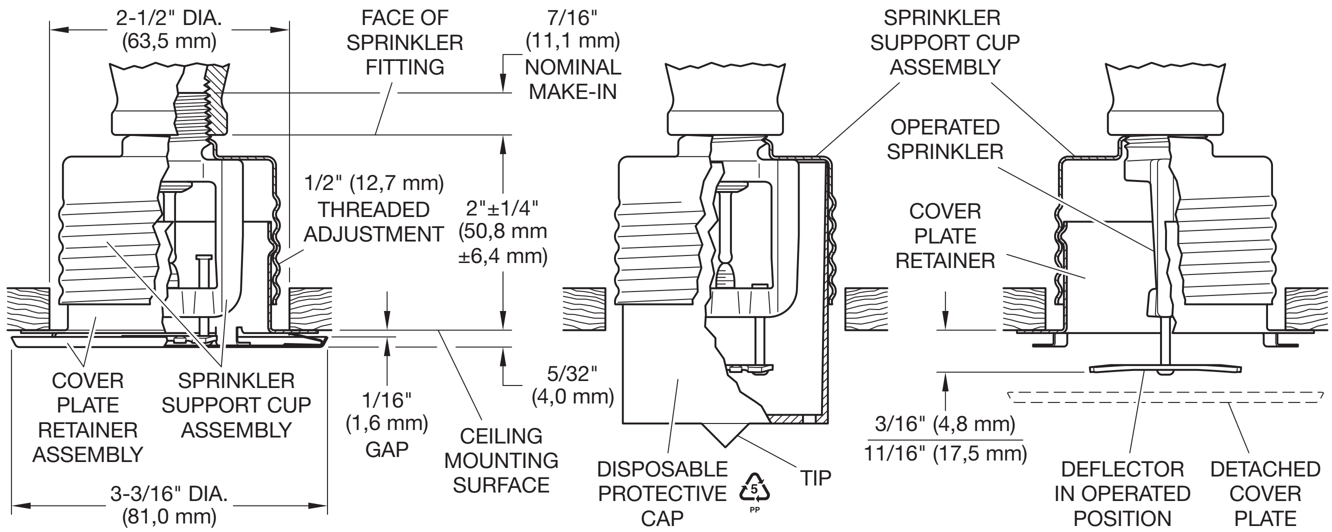


FIGURE 2
SERIES RFII-C SPRINKLER INSTALLATION DIMENSIONS

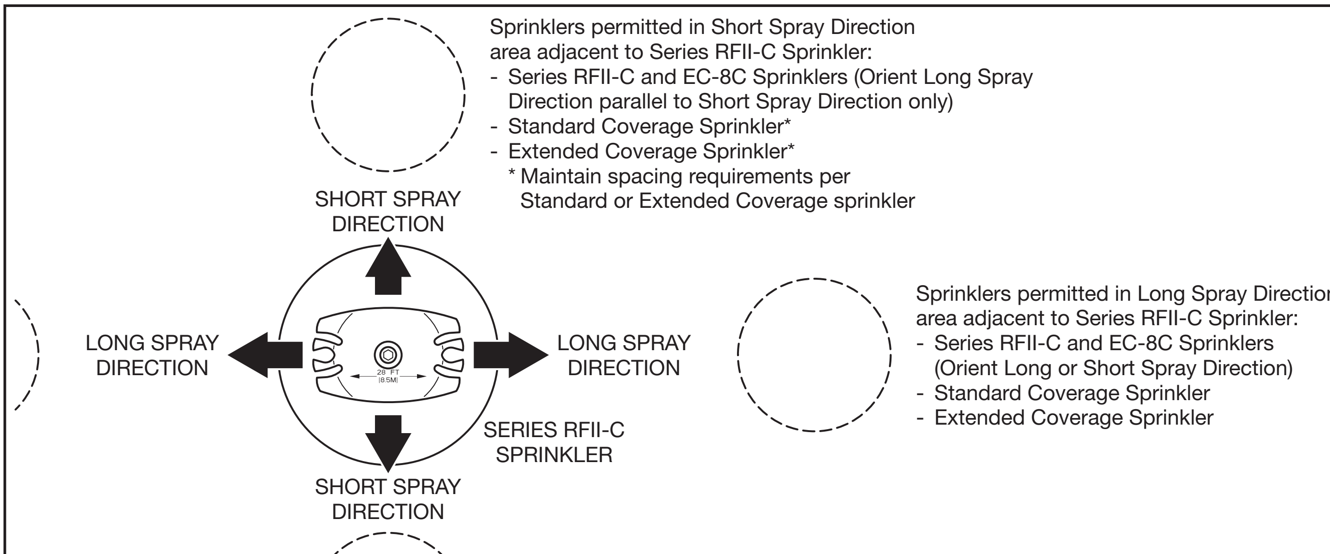


FIGURE 3
SPRINKLERS ADJACENT TO
SERIES RFII-C SPRINKLER

Operation

When exposed to heat from a fire, the cover plate, which is normally soldered to the retainer at three points, falls away to expose the sprinkler/support cup assembly.

The deflector, supported by the guide pins, then drops down to its operational position.

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, activating the sprinkler and allowing water to flow.

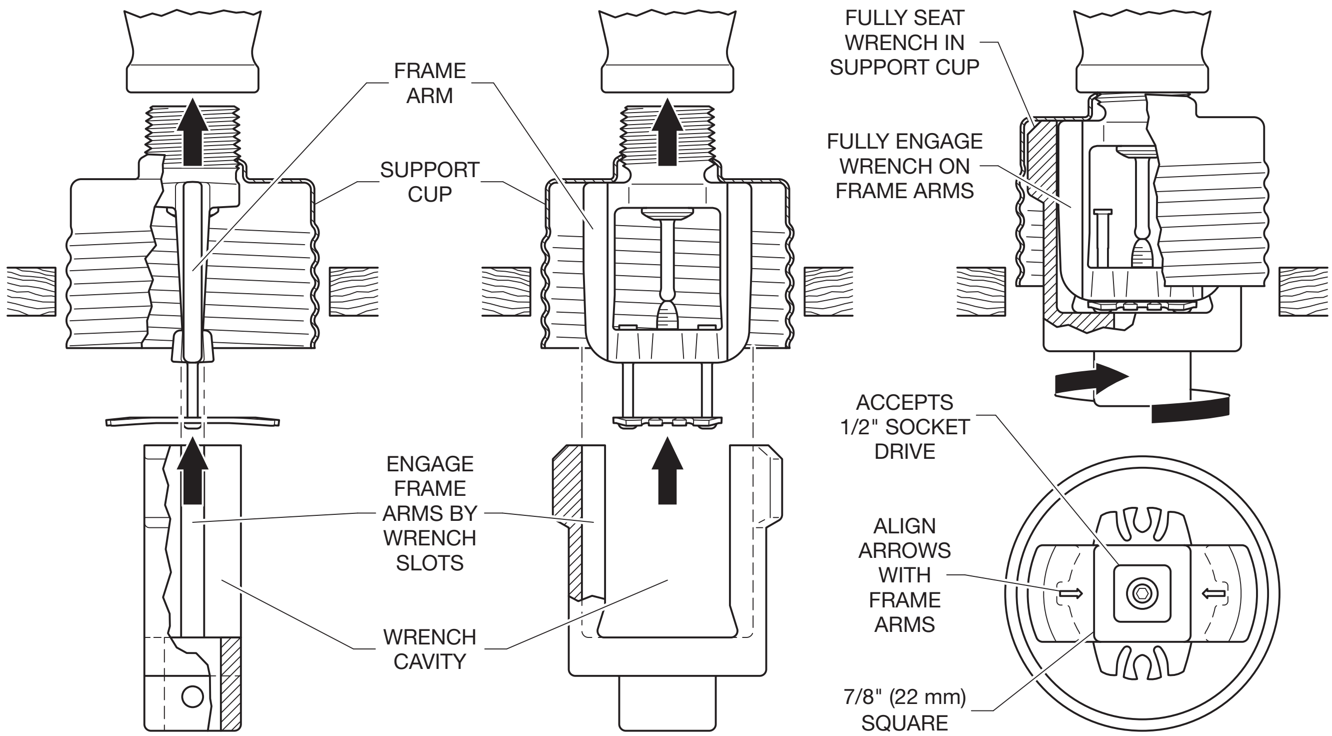


FIGURE 4
RFII-C W-TYPE 40 SPRINKLER WRENCH

Installation

The TYCO Series RFII-C, 5.6 K-factor Special Application Royal Flush II Quick Response Concealed Pendent Sprinklers must be installed in accordance with this section.

General Instructions
Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 in. (1,6 mm) for the 155°F (68°C) and 3/32 in. (2,4 mm) for the 200°F (93°C) temperature ratings.

Obtain a 1/2 in. NPT sprinkler joint by applying a minimum to maximum torque of 7 ft-lb to 14 ft-lb (9,5 N·m to 19,0 N·m). Higher levels of torque can distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the sprinkler by under- or over-tightening the sprinkler/support cup assembly. Re-adjust the position of the sprinkler fitting to suit.

Step 1. Install the sprinkler only in the pendent position with the centerline of the sprinkler perpendicular to the mounting surface.

Note: *The sprinkler must be installed with the deflector parallel to the mounting surface. The deflector is marked with <-28 FT (8,5 M)-> to indicate the direction of the 28 ft (8,5 m) coverage length. The frame arms do not need to be aligned parallel to the sprinkler pipe.*

Step 2. Remove the protective cap.

Step 3. Apply pipe thread sealant to the pipe threads, and hand-tighten the sprinkler into the sprinkler fitting.

Step 4. Wrench tighten the deflector using only the W-Type 40 Sprinkler Wrench shown in Figure 4 so that the marking <-28 FT (8,5 M)-> on the deflector is in the direction of the 28 ft (8,5 m) coverage length. The frame arms do not need to be aligned parallel to the sprinkler pipe. Apply the wrench to the sprinkler as shown in Figure 4.

Step 5. Replace the protective cap by pushing it upwards until it bottoms out against the support cup as shown in Figure 4.

The protective cap helps prevent damage to the deflector and frame arms when installing or finishing the ceiling. You can also use it to locate the center of the clearance hole by gently pushing the ceiling material up against the center point of the protective cap.

NOTICE

As long as the protective cap remains in place, the system is considered "Out of Service".

Step 6. When the ceiling is complete with the 2-1/2 in. (63,5 mm) diameter clearance hole; to prepare for installing the cover plate/retainer assembly, remove and discard the protective cap.

Verify that the deflector moves up and down freely. If the sprinkler is damaged and the deflector does not move up and down freely, replace the entire sprinkler. Do not attempt to modify or repair a damaged sprinkler.

Step 7. Screw on the cover plate/retainer assembly until its flange makes contact with the ceiling. Do not continue to screw on the cover plate/retainer assembly so that it lifts a ceiling panel out of its normal position. If you cannot engage the cover plate/retainer assembly with the support cup or you cannot engage the cover plate/retainer assembly sufficiently to contact the ceiling, you must reposition the sprinkler fitting.

Care and Maintenance

The TYCO Series RFII-C, 5.6 K-factor Special Application Royal Flush II Quick Response Concealed Pendent Sprinklers must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection system from the proper authorities and notify all personnel who may be affected by this action.

Absence of the cover plate/retainer assembly can delay sprinkler operation in a fire situation.

When properly installed, there is a nominal 3/32 in. (2,4 mm) air gap between the lip of the cover plate and the ceiling, as shown in Figure 2. This air gap is necessary for proper operation of the sprinkler. If the ceiling requires repainting after sprinkler installation, ensure that the new paint does not seal off any of the air gap.

Do not pull the cover plate relative to the enclosure. Separation may result.

Replace sprinklers that are leaking or exhibiting visible signs of corrosion.

Never repaint, plate, coat, or otherwise alter automatic sprinklers after they leave the factory. Never repaint factory-painted cover plates. If necessary, replace them with factory-painted units. Non-factory applied paint can adversely delay or prevent sprinkler operation in the event of a fire.

Replace modified or over-heated sprinklers.

Exercise care to avoid damage to the sprinklers before, during, and after installation. Replace sprinklers damaged by dropping, striking, wrench twisting, wrench slipping, or the like. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. Refer to the Installation Section.

If you must remove a sprinkler, do not reinstall it or a replacement without reinstalling the cover plate/retainer assembly. If a cover plate/retainer assembly becomes dislodged during service, replace it immediately.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION such as NFPA 25, in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

Automatic sprinkler systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national code.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Sprinkler/Support Cup Assembly
Specify: Series RFII-C Special Application Royal Flush Concealed Pendent Sprinkler, TY3582, for Corridor or Hallway Applications, (specify) temperature rating, P/N (specify):

155°F (68°C)
TY3582 51-734-1-155

200°F (93°C)
TY3582 51-734-1-200

Separately Ordered Cover Plate/ Retainer Assembly
Specify: (temperature rating, listed below) Series RFII Concealed Cover Plate with (finish), P/N (specify):

139°F (59°C)[a]
Grey White (RAL9002) 56-792-0-135
Brass. 56-792-1-135
Pure White[c] (RAL9010) 56-792-3-135
Signal White (RAL9003) 56-792-4-135
Jet Black (RAL9005) 56-792-6-135
Chrome 56-792-9-135
Custom 56-792-X-135

165°F (74°C)[b]
Grey White (RAL9002) 56-792-0-165
Brass. 56-792-1-165
Pure White[c] (RAL9010) 56-792-3-165
Signal White (RAL9003) 56-792-4-165
Jet Black (RAL9005) 56-792-6-165
Chrome 56-792-9-165
Custom 58-792-X-165

NOTES
a. For use with 155°F (68°C) sprinklers
b. For use with 200°F (93°C) sprinklers
c. Eastern Hemisphere sales only

Sprinkler Wrench
Specify: W-Type 40 Sprinkler Wrench, P/N 56-000-1-076

1467 Elmwood Avenue, Cranston, RI 02910 | Telephone +1-401-781-8220

Johnson Controls

Series EC-11 and EC-14 Sprinklers, 11.2 K and 14.0 K Upright and Pendent Extended Coverage Light and Ordinary Hazard

IMPORTANT
Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp220

General Description

TYCO Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers are decorative glass-bulb sprinklers designed for use in light or ordinary hazard occupancies. They are intended for use in automatic sprinkler systems designed in accordance with standard installation rules, such as NFPA 13, for a maximum coverage area of 400 ft² (37,2 m²) as compared to the maximum coverage area of 130 ft² (12,1 m²) for standard coverage sprinklers used in ordinary hazard occupancies, Series EC-11 and EC-14 Extended Coverage Sprinklers feature a UL and C-UL Listing that permits their use with unobstructed or non-combustible obstructed ceiling construction as defined and permitted by NFPA 13, as well as a specific application listing for use under concrete tees.

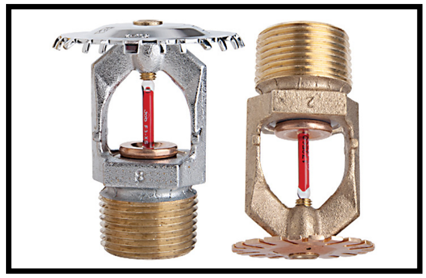
Series EC-11 and EC-14 Extended Coverage Sprinklers have been fire tested to compare their performance to that of standard coverage spray sprinklers. These tests have shown that the protection provided is equal to or more effective than standard coverage spray sprinklers.

Corrosion-resistant coatings, where applicable, help extend the life of copper alloy sprinklers beyond that which occurs when exposed to corrosive atmospheres. Although corrosion-resistant coated sprinklers passed standard corrosion tests of the applicable approval agencies, this testing is not representative of all possible corrosive atmospheres. Consequently, it is recommended that the end user be consulted with respect to the suitability of these corrosion-resistant coatings for any given corrosive environment. The effects of ambient temperature, concentration of chemicals, and gas/chemical velocity should be considered, along with the corrosive nature of the chemical to which the sprinklers will be exposed.

NOTICE

Series EC-11 and EC-14 Extended Coverage Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION, (NFPA), in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.



Sprinkler Identification Numbers

TY5137 . . . . Upright, 11.2K
TY5237 . . . . .Pendent, 11.2K
TY6137 . . . . Upright, 14.0K
TY6237 . . . . Pendent, 14.0K

TY5137 is a re-designation for C5137, G1894, and S2510
TY5237 is a re-designation for C5237, G1893, and S2511
TY6137 is a re-designation for C6137, G1896, and S2610
TY6237 is a re-designation for C6237, G1895, and S2611

Technical Data

Approvals

Series EC-11 and EC-14 Sprinklers
UL and C-UL Listed
FM Approved
EAC Approved

Note: *For complete sprinkler approval information including corrosion-resistant status, see Table A. The approvals apply to the service conditions indicated in the Design Criteria section.*

Escutcheons
The Style 60 Two-Piece Flush Escutcheon, as shown in Figure 4, is UL Listed for use with the Series EC-11 and EC-14 Pendent Sprinklers.

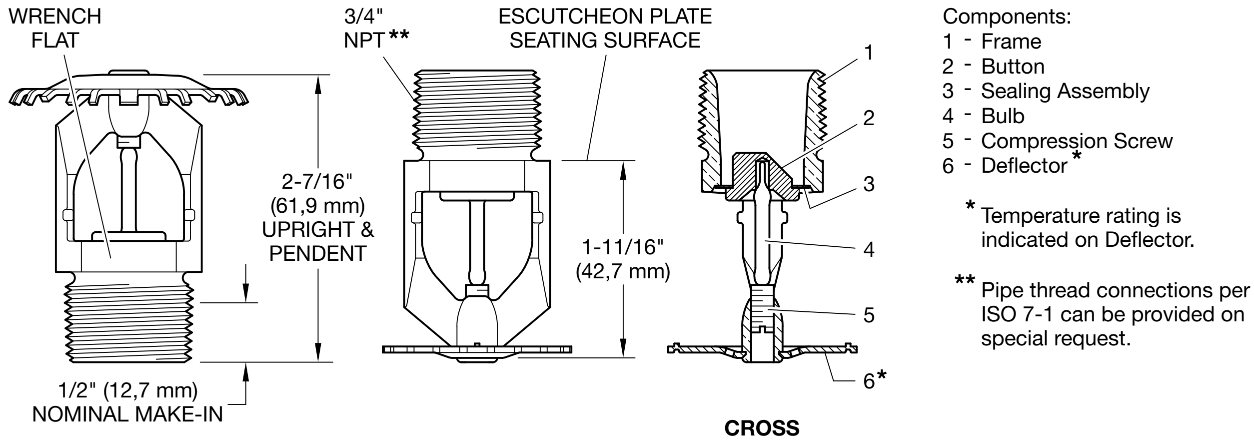


FIGURE 1
SERIES EC-11 AND EC-14 EXTENDED COVERAGE SPRINKLERS
11.2 K-FACTOR UPRIGHT (TY5137) AND PENDENT (TY5237)
14.0 K-FACTOR UPRIGHT (TY6137) AND PENDENT (TY6237)
ASSEMBLY

Maximum Working Pressure
175 psi (12,1 bar)

Pipe Thread Connection
3/4 in. NPT

Discharge Coefficients
K = 11.2 GPM/psi$^{1/2}$ (161,3 LPM/bar$^{1/2}$)
K = 14.0 GPM/psi$^{1/2}$ (201,6 LPM/bar$^{1/2}$)

Temperature Ratings
See Table A

Finish
Sprinkler: See Table A

Recessed or Flush Escutcheon: White-Coated, Chrome-Plated, and Brass-Plated

Physical Characteristics
Frame . . . . Bronze
Button. . . . . Bronze
Sealing Assembly . Beryllium Nickel w/TEFLON
Bulb . . . . Glass (3 mm)
Compression Screw . . . . Bronze
Deflector. . . . . Brass

Operation

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, which then allows the sprinkler to activate and flow water.

Design Criteria

TYCO Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers must only be installed in accordance with the applicable UL and C-UL Listing or FM Approval requirements as indicated below. Only Style 30 or 40 Recessed Escutcheons are to be used for recessed installation, as applicable. See Tables A, B, and C, for more information.

UL and C-UL Listing Requirements

1. Series EC-11 and EC-14 Extended Coverage Sprinklers may be used for the coverage areas shown in Table D, based on maintaining the minimum specified flow rate as a function of coverage area and hazard group for all sprinklers in the design area.

2. Series EC-11 and EC-14 Extended Coverage Sprinklers are permitted to be used with unobstructed or non-combustible obstructed ceiling construction as defined and permitted by NFPA 13; for example:

- Unobstructed, combustible or noncombustible, ceiling construction with a deflector to ceiling/roof deck distance of 1 to 12 in. (25 to 300 mm).
- Obstructed, non-combustible, ceiling construction with a deflector location below structural members of 1 to 6 in. (25 to 150 mm) and a maximum deflector to ceiling/roof deck distance of 22 in. (550 mm).

3. Series EC-11 and EC-14 Extended Coverage Sprinklers, specifically tested and listed for non-combustible obstructed construction, are permitted to be used within trusses or bar joists having non-combustible web members greater than 1 in. (25,4 mm) when applying the 4 times obstruction criteria rule defined under “Obstructions to Sprinkler Discharge Pattern Development”.

4. To prevent cold soldering, the minimum allowable spacing between Series EC-11 and EC-14 Extended Coverage Sprinklers is 8 ft (2,4 m) for upright sprinklers and 9 ft (2,7 m) for pendent sprinklers.

5. Series EC-11 and EC-14 Extended Coverage Sprinklers are to be installed in accordance with all other requirements of NFPA 13 for extended coverage upright and pendent sprinklers; For example, obstructions to sprinkler discharge, obstructions to sprinkler pattern development, obstructions to prevent sprinkler discharge from reaching hazard and clearance to storage.

UL and C-UL Specific Application Listing Requirements for Installation under Concrete Tees
Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers (TY5137, TY5237, TY6137 and TY6237) have a UL and C-UL Specific Application Listing for use under concrete tees when installed as follows:

1. Stems of the concrete tee construction must be spaced at less than 7.5 ft (2,3 m) on center but more than 3 ft (0,9 m) on center. The depth of the concrete tees must not

<table>
<tr><th rowspan="2">Hazard</th><th rowspan="2">Type</th><th rowspan="2">Temperature</th><th rowspan="2">Bulb Liquid</th><th colspan="4">Sprinkler Finish[6]</th></tr>
<tr><th>Natural Brass</th><th>Chrome Plated</th><th>Polyester*</th><th>Lead Coated</th></tr>
<tr><td rowspan="10">Light

Table B describes UL and C-UL Sensitivity Rating
Table C describes FM Sensitivity Rating</td><td rowspan="5">Upright
K=11.2 (TY5137)
Pendent
K=11.2 (TY5237)
K=14.0 (TY6237)</td><td>135°F (57°C)</td><td>Orange</td><td colspan="4" rowspan="3">1, 2, 3**, 4, 5</td></tr>
<tr><td>155°F (68°C)</td><td>Red</td></tr>
<tr><td>175°F (79°C)</td><td>Yellow</td></tr>
<tr><td>200°F (93°C)</td><td>Green</td><td colspan="3" rowspan="2">1, 2, 4, 5</td><td rowspan="2">1, 2, 4, 5</td></tr>
<tr><td>286°F (141°C)</td><td>Blue</td></tr>
<tr><td rowspan="5">Recessed Pendent
K=11.2 (TY5237)
K=14.0 (TY6237)
With Style 30
Escutcheon</td><td>135°F (57°C)</td><td>Orange</td><td colspan="3" rowspan="2">1, 2, 3, 4, 5</td><td rowspan="5">N/A</td></tr>
<tr><td>155°F (68°C)</td><td>Red</td></tr>
<tr><td>175°F (79°C)</td><td>Yellow</td><td colspan="3" rowspan="3">1, 2, 4, 5</td></tr>
<tr><td>200°F (93°C)</td><td>Green</td></tr>
<tr><td>286°F (141°C)</td><td>Blue</td></tr>
<tr><td rowspan="9">Ordinary

Table B describes UL and C-UL Sensitivity Rating
Table C describes FM Sensitivity Rating</td><td rowspan="5">Upright
K=11.2 (TY5137)
K=14.0 (TY6137)
Pendent
K=11.2 (TY5237)
K=14.0 (TY6237)</td><td>135°F (57°C)</td><td>Orange</td><td colspan="3" rowspan="5">1, 2, 3, 4, 5</td><td rowspan="2">1, 2, 3, 4, 5</td></tr>
<tr><td>155°F (68°C)</td><td>Red</td></tr>
<tr><td>175°F (79°C)</td><td>Yellow</td><td rowspan="3">1, 2, 4, 5</td></tr>
<tr><td>200°F (93°C)</td><td>Green</td></tr>
<tr><td>286°F (141°C)</td><td>Blue</td></tr>
<tr><td rowspan="4">Recessed Pendent
K=11.2 (TY5237)
K=14.0 (TY6237)
With Style 30 or 40
Escutcheon</td><td>135°F (57°C)</td><td>Orange</td><td colspan="3" rowspan="4">1, 2, 4, 5</td><td rowspan="4">N/A</td></tr>
<tr><td>155°F (68°C)</td><td>Red</td></tr>
<tr><td>175°F (79°C)</td><td>Yellow</td></tr>
<tr><td>200°F (93°C)</td><td>Green</td></tr>
</table>

NOTES
1. Listed by Underwriters Laboratories, Inc. (UL)
2. Listed by Underwriters Laboratories, Inc., for use in Canada (C-UL)
3. Approved by Factory Mutual Research Corporation (FM)
4. Approved by the City of New York under MEA 177-03-E
5. EAC Approved
6. Where Polyester Coated or Lead Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion Resistant Sprinklers

N/A = Not Available
* Frame and Deflector only
** Pendent only

TABLE A
LABORATORY LISTINGS AND APPROVALS

Area ft x ft	Style	Light Hazard 135°F (57°C)	Light Hazard 155°F (68°C)	Light Hazard 175°F (79°C)	Light Hazard 200°F (93°C)	Light Hazard 286°F (141°C)	Ordinary Hazard 135°F (57°C)	Ordinary Hazard 155°F (68°C)	Ordinary Hazard 175°F (79°C)	Ordinary Hazard 200°F (93°C)	Ordinary Hazard 286°F (141°C)
14 x 14	Upright or Pendent	-	-	-	-	-	QR	QR	QR	QR	QR
	Style 30 Recessed	-	-	-	-	-	QR	QR	QR	QR	QR
	Style 40 Recessed	-	-	-	-	-	QR	QR	QR	QR	QR
16 x 16	Upright or Pendent	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	SR
	Style 30 Recessed	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	SR
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	SR
18 x 18	Upright or Pendent	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	SR
	Style 30 Recessed	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	SR
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	SR
20 x 20	Upright or Pendent	QR*	QR*	QR*	SR*	SR*	SR	SR	SR	SR	SR
	Style 30 Recessed	QR*	QR*	QR*	SR*	SR*	SR	SR	SR	SR	SR
	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	SR

NOTES
- QR = Quick Response
- SR = Standard Response
- N/A = Not Applicable

* Does not apply to Upright K=14.0

TABLE B
SENSITIVITY RATING FOR UL AND C-UL LISTING OF SERIES EC-11 OR EC-14 SPRINKLERS
(SEE TABLE D FOR PERMITTED K-FACTOR/AREA COMBINATIONS)

HC-1

Linear Spacing ft		Area Spacing ft		Ceiling Height ft	Ceiling Type	K-factor	Style	Response
Min	Max	Min	Max					
10	20	100	400	Up to 30	Noncombustible Unobstructed, Noncombustible Obstructed, or Combustible Unobstructed	11.2 EC 14.0 EC	Pendent or Upright	Quick
10	20	100	400	Up to 30	Noncombustible Unobstructed, Noncombustible Obstructed, or Combustible Unobstructed	11.2 EC 14.0 EC	Pendent Recessed Style 30	
10	20	100	400	Up to 30	Combustible Obstructed	11.2 EC 14.0 EC	Pendent or Upright	
10	20	100	400	Up to 30	Combustible Obstructed	11.2 EC 14.0 EC	Pendent Recessed Style 30	
10	20	100	400	Over 30 and up to 45	Noncombustible Unobstructed	11.2 EC 14.0 EC	Upright	

HC-2

Linear Spacing ft		Area Spacing ft		Ceiling Height ft	Ceiling Type	K-factor	Style	Response
Min	Max	Min	Max					
10	20	100	400	Up to 30	Noncombustible Unobstructed, Combustible Unobstructed	11.2 EC	Pendent or Upright	Quick
10	20	100	400	Up to 30		14.0 EC	Pendent or Upright	
10	16	100	256	Over 30 and up to 45		11.2 EC 14.0 EC	Upright	

HC-3

Linear Spacing ft		Area Spacing ft		Ceiling Height ft	Ceiling Type	K-Factor	Style	Response
Min	Max	Min	Max					
10	16	100	256	Up to 30	Noncombustible Unobstructed, Combustible Unobstructed	11.2 EC	Upright	Quick
10	20	100	400	Up to 30		14.0 EC	Pendent or Upright	
10	16	100	256	Over 30 and up to 45		11.2 EC, 14.0 EC	Upright	

NOTES
- The design for K 11.2 EC (K 160 EC) sprinklers should not include fewer than six sprinklers or have a design pressure of less than 12 psi (0,8 bar); similarly the design for K 14.0 EC (K 200 EC)sprinklers should not include fewer than four sprinklers or have a design pressure of less than 18 psi (1,2 bar).
- For flow criteria, refer to FM Loss Prevention Data Sheet 3-26.
- Refer to FM Loss Prevention Data Sheet 2-0 for permitted K-Factor/Area Combinations.

TABLE C
SENSITIVITY RATING FOR FM APPROVAL OF SERIES EC-11 OR EC-14 SPRINKLERS

exceed 30 in. (762 mm). The maximum permitted concrete tee length is 32 ft (9,8 m). However, where the concrete tee length exceeds 32 ft (9,8 m), non-combustible baffles, equal in height to the depth of the tees, can be installed so that the space between the tees does not exceed 32 ft (9,8 m) in length.

2. The sprinkler deflectors are to be located in a horizontal plane at or above 1 in. (25,4 mm) below the bottom of the concrete tee stems.

3. When the sprinkler deflectors are located higher than a horizontal plane 1 in. (25,4 mm) beneath the bottom of the concrete tee stems, the obstruction to sprinkler discharge criteria requirements of NFPA 13 for extended coverage upright and pendent sprinklers applies.

FM Approval Requirements
Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers are to be installed in accordance with the applicable FM Loss Prevention Data Sheet for limited use in buildings of specific roof construction and for the protection of certain specific ordinary hazard (non-storage and/or non-flammable or combustible liquid) occupancies. Information provided in the FM Loss Prevention Data Sheets relates to, but is not limited to, hydraulic design, ceiling slope, and obstructions, minimum and maximum allowable spacing, and deflector-to-ceiling distance.

These criteria may differ from UL and/or NFPA criteria. Therefore, the designer should review and become familiar with FM requirements before proceeding with design.

Description	Area ft x ft	Light Hazard 0.10 GPM/ft^2		Group I Ordinary Hazard 0.15 GPM/ft^2		Group II Ordinary Hazard 0.20 GPM/ft^2	
		GPM	PSI	GPM	PSI	GPM	PSI
TY5137 (K=11.2) Upright	14 x 14	30	7.2	30	7.2	39	12.1
	16 x 16	30	7.2	39	12.1	51	20.7
	18 x 18	33	8.7	49	19.1	65	33.7
	20 x 20	40	12.8	60	28.7	80	51.0
TY5237 (K=11.2) Pendent	14 x 14	30	7.2	30	7.2	39	12.1
	16 x 16	30	7.2	39	12.1	51	20.7
	18 x 18	33	8.7	49	19.1	65	33.7
	20 x 20	40	12.8	60	28.7	80	51.0
TY6137 (K=14.0) Upright	14 x 14	N/A	N/A	39	7.8	51	13.3
	16 x 16	N/A	N/A	39	7.8	51	13.3
	18 x 18	N/A	N/A	49	12.3	65	21.6
	20 x 20	N/A	N/A	60	18.4	80	32.7
TY6237 (K=14.0) Pendent	14 x 14	37	7.0	39	7.8	51	13.3
	16 x 16	37	7.0	39	7.8	51	13.3
	18 x 18	37	7.0	49	12.3	65	21.6
	20 x 20	40	8.2	60	18.4	80	32.7

NOTES
- 1 ft = 0,3048 m
- 1 ft^2 = 0,093 m^2
- 1 GPM = 3,785 LPM
- 1 psi = 0,06895 bar
- 1 GPM/ft^2 = 40,74 mm/min

TABLE D
FLOW CRITERIA FOR UL AND C-UL LISTING OF SERIES EC-11 AND EC-14 SPRINKLERS

Installation

TYCO Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers must be installed in accordance with this section.

General Instructions
Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 in. (1,6 mm) for the 135°F (57°C) to 3/32 in. (2,4 mm) for the 286°F (141°C) temperature ratings.

A leak-tight 3/4 in. NPT sprinkler joint should be obtained by applying a minimum-to-maximum torque of 10 to 20 lb-ft (13,4 to 26,8 N·m). Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in an Escutcheon Plate by under or over-tightening the Sprinkler. Re-adjust the position of the sprinkler fitting to suit.

Step 1. Install the sprinkler with the deflector parallel to the mounting surface. Install pendent sprinklers in the pendent position. Install upright sprinklers in the upright position.

Step 2. After installing the Style 30, 40, or 60 mounting plate, or other applicable escutcheon, over the sprinkler pipe threads and with pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step 3. For upright or pendent sprinklers, wrench-tighten using only the W-Type 3 (End A) Sprinkler Wrench. For the pendent sprinkler installed with Style 30, 40, or 60 Escutcheon, wrench-tighten the sprinkler using only the W-Type 22 Sprinkler Wrench.

Apply the wrench recess of the applicable sprinkler wrench, as shown in Figure 5 or Figure 6, to the sprinkler wrench flats, as shown in Figure 1.

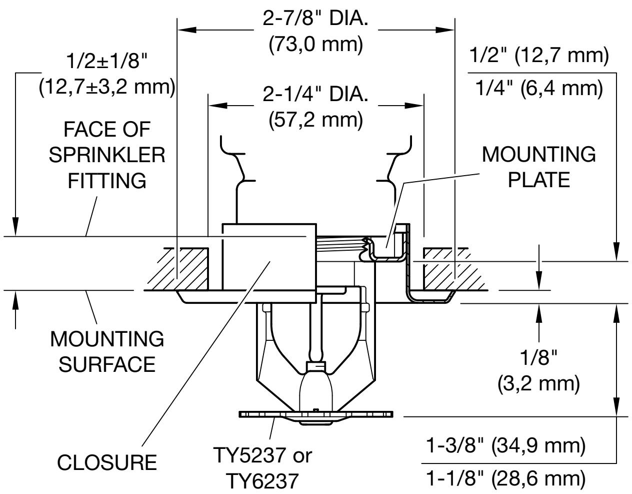


FIGURE 2
SERIES EC-11 AND EC-14 RECESSED PENDENT SPRINKLER ASSEMBLY WITH TWO-PIECE 1/2 IN. TOTAL ADJUSTMENT STYLE 30 RECESSED ESCUTCHEON

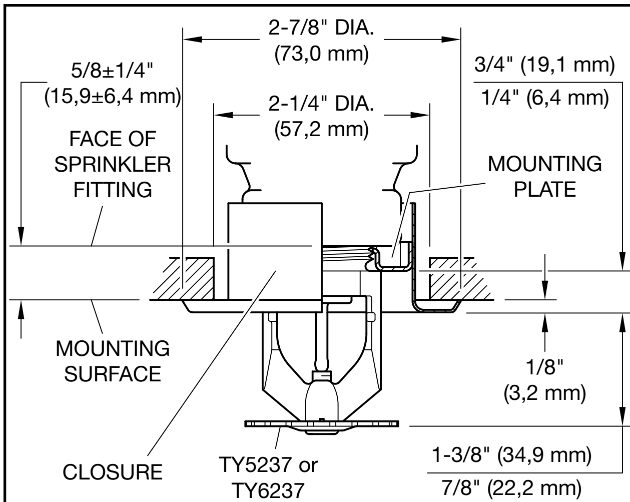


FIGURE 3
SERIES EC-11 AND EC-14 RECESSED PENDENT SPRINKLER ASSEMBLY WITH TWO-PIECE 3/4 IN. TOTAL ADJUSTMENT STYLE 40 RECESSED ESCUTCHEON

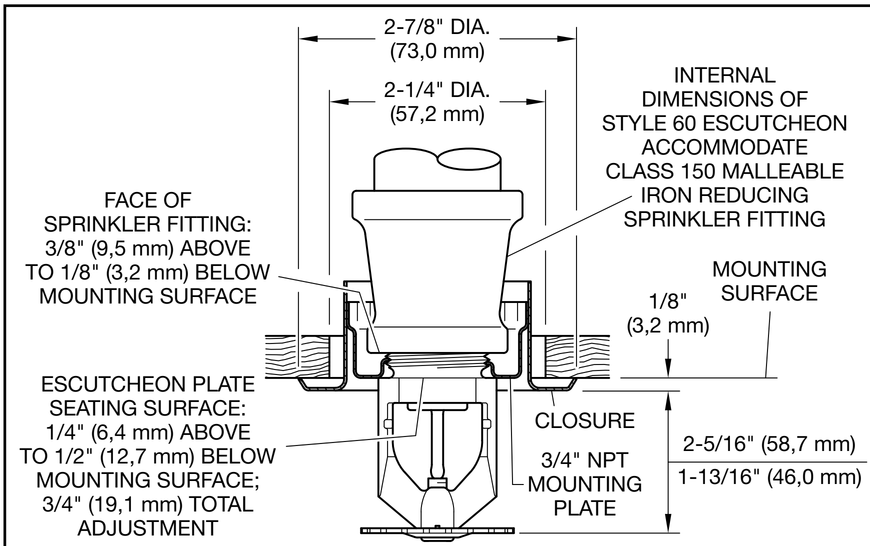


FIGURE 4
SERIES EC-11 AND EC-14 PENDENT SPRINKLER ASSEMBLY WITH 3/4 IN. TOTAL ADJUSTMENT STYLE 60 TWO-PIECE FLUSH ESCUTCHEON

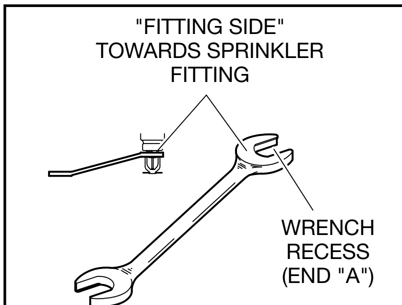


FIGURE 5
W-TYPE 3 SPRINKLER WRENCH

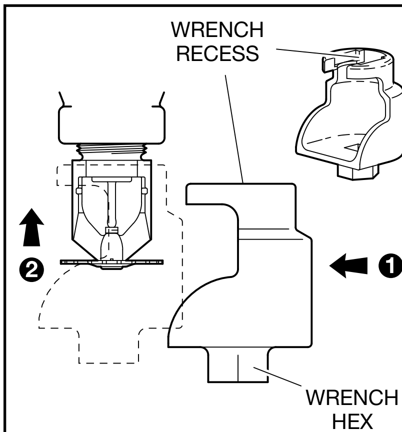


FIGURE 6
W-TYPE 22 RECESSED SPRINKLER WRENCH

P/N 51 – XXX – X – XXX

		SIN
893	11.2K Pendent	TY5237
894	11.2K Upright	TY5137
895	14.0K Pendent	TY6237
896	14.0K Upright	TY6137

NOTES:
1. Escutcheon ordered separately.
2. OPEN indicates the sprinkler assembly without glass bulb, button, and sealing assembly.

	SPRINKLER FINISH[1]
1	NATURAL BRASS
4	SIGNAL WHITE (RAL9003) POLYESTER
5	JET BLACK (RAL9005) POLYESTER
7	LEAD COATED
9	CHROME-PLATED

	TEMPERATURE RATING
135	135°F (57°C)
155	155°F (68°C)
175	175°F (79°C)
200	200°F (93°C)
286	286°F (141°C)
000	OPEN[2]

TABLE E
SERIES EC-11 AND EC-14 UPRIGHT AND PENDENT SPRINKLERS
PART NUMBER SELECTION

Care and Maintenance

TYCO Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection systems from the proper authorities and notify all personnel who may be affected by this action.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. Refer to the Installation section, for more information.

Frequent visual inspections are recommended to be initially performed for corrosion resistant coated sprinklers, after the installation has been completed, to verify the integrity of the corrosion resistant coating. Thereafter, annual inspections per NFPA 25 should suffice; however, instead of inspecting from the floor level, a random sampling of close-up visual inspections should be made, so as to better determine the exact sprinkler condition and the long term integrity of the corrosion resistant coating, as it may be affected by the corrosive conditions present.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards recognized by the Approval agency, such as NFPA 25, in addition to the standards of any authorities having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Sprinkler Assemblies with NPT Thread Connections
Specify: Series EC-11 or EC-14 (specify) Sprinkler, SIN (specify), (specify) K-factor, Pendent or Upright (specify) Extended Coverage, (specify) temperature rating, (specify) finish, P/N (from Table E)

Recessed Escutcheon, Two-Piece
Specify: Style (30 or 40) Two-Piece Recessed Escutcheon with (specify) finish, P/N (specify*)

*Refer to Technical Data Sheet TFP770

Flush Escutcheon, Two-Piece
Specify: Style 60 Two-Piece Flush Escutcheon with (specify) finish, P/N (specify**)

**Refer to Technical Data Sheet TFP778

Sprinkler Wrenches
Specify: W-Type 3 Sprinkler Wrench, P/N 56-895-1-001

Specify: W-Type 22 Recessed Sprinkler Wrench, P/N 56-665-7-001

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tyco®

Worldwide Contacts | www.tyco-fire.com

TFP220
Change History Appendix

ISSUE DATE	NOTES
08-22	Page 1, updated QR code and URL; Page 1, Approvals sub-section, added EAC Approved; Page 8, changed corporate address and telephone number to 1467 Elmwood Avenue, Cranston, RI 02910 | Telephone +1-401-781-8220, formerly 1400 Pennbrook Parkway, Lansdale, PA 19446 | Telephone +1-215-362-0700.
11-21	Added QR code and URL to allow convenient access to electronic version from printed document.
06-19	Added pendent orientation for 11.2 K-factor variant in Hazard Class 2 (HC-2) Ceiling Height up to 30 feet to Sensitivity Rating for FM Approval Table C.
10-18	Updated Table B to identify which K=14 Upright sprinklers are not Quick or Standard Reponse.
08-18	Updated Tyco® branding and document format; Added Johnson Controls copyright; Added disclaimer stating specifications and information subject to change without notice; Added reference to Regulatory and Health Warning Technical Data Sheet TFP2300; Changed metric conversion factor in Table D to 1 ft = 0.3048 m, formerly 1 ft = 0.348 m.
12-17	Expanded applicability of laboratory listings and approvals relative to hazard, sprinkler type and temperature rating.
11-14	Added Jet Black (RAL9005) sprinkler finish to Part Number Selection Table E.
09-14	Corrected sprinkler orientation in Design Criteria, UL and C-UL Specific Application Listing Requirements for Installation under Concrete Tees sub-section, pendent EC-11 and EC-14 sprinklers are also subject to NFPA 13 discharge criteria requirements when installed with deflectors located higher than a horizontal plane 1 inch (25,4 mm) beneath the bottoms of concrete tee stems.
06-14	Corrected SIN numbers shown in Figure 1 caption.
05-14	Corrected Sensitivity Ratings in Table C.
02-14	Changed ceiling heights per FM Approval to limited to 45 feet; formerly over 30 feet; Added option for Open sprinklers to Ordering Procedure (Open indicates a sprinkler assembly without Bulb, Button or Sealing Assembly).
11-13	Added Sensitivity Ratings to Ordinary Hazard applications in Table B, formerly Not Applicable (N/A); Added Flow and Pressure criteria to Table D.
02-12	Corrected typographical errors in coverage areas provided in Table D.
09-11	Updated to reflect current legal and department standards.
07-11	Updated patent information.
12-07	Added reference to new UL Listed and FM Approved Style 60 Two-Piece Flush Escutcheon.
02-07	Changed UL and C-UL Listied sensitivity rating of operating temperatures up to 200°F (93°C) to to quick response for ordinary hazard 14' x 14' coverage areas; formerly standard response.
09-04	Added UL and C-UL Listed installation criteria for non-combustible web members greater than 1 inch within trusses and or bar joists; Added UL and C-UL Listed installation criteria for pendent sprinklers located beneath concrete tees.
04-04	Added NYC Approved; Changed recessed sprinkler wrench to W-Type 22 which accommodates protective Sprinkler Strap, formerly W-Type 4.
02-04	Updated Listings and Approvals; Added Style 30 Recessed Escutcheon to Table B under ordinary hazard for UL and C-UL; Added NYC Approved to Table A as applicable.
04-03	Corrected FM sensitivity rating in Table for ordinary hazard recessed style to Not Applicable (N/A), formerly Standard Response (SR).

ISSUE DATE	NOTES
01-03	Added new Tyco Fire & Building Products masthead.
10-02	New Technical Data Sheet TFP220 describes Series EC-11 and EC-14 Extended Coverage Pendent and Upright Sprinklers.

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Johnson Controls

Victaulic® FireLock™ Series FL-SA/RE and FL-SA/DS Specific Application Low Flow Attic Scheme, Quick Response Upright, K5.6 (8.1)

46.02

FL-SA/RE, V5620

FL-SA/DS, V5621

1.0 PRODUCT DESCRIPTION

SPECIFIC APPLICATION ATTIC SPRINKLERS		
SIN	**V5620**	**V5621**
ORIENTATION	Upright	Upright
K-FACTOR[1]	5.6 Imp./8.1 S.I.	5.6 Imp./8.1 S.I.
CONNECTION	½" NPT	½" NPT
MAX. WORKING PRESSURE	175 psi (1200 kPa)	175 psi (1200 kPa)
GLOBE RE-DESIGNATION	GL5620	GL5621

AVAILABLE WRENCHES	
SPRINKLER	**V56 Open End**
Upright	■

Factory Hydrostatic Test: 100% @ 500 psi/3447 kPa/34 bar

Min. Operating Pressure: UL: 12.8 psi/88 kPa/0.9 bar

Temperature Rating: See tables in section 2.0

[1] For K-Factor when pressure is measured in bar, multiply S.I. units by 10.0.

2.0 CERTIFICATION/LISTINGS

c UL us LISTED

Sprinkler Model	SIN	Nominal K Factor Imperial	Listing Agency/Approved Temperature Ratings	Area of Use	Roof Span ft	Roof Pitch
RE	V5620	5.6	cULus 200°F/93°C	Gable Roof	72' MAX	3:12 to 6:12
RE	V5620	5.6	cULus 200°F/93°C	HIP	NA	3:12 to 12:12
DS	V5621	5.6	cULus 200°F/93°C	Gable Roof	72' MAX	3:12 to 6:12
DS	V5621	5.6	cULus 200°F/93°C	HIP/Single Slope	NA	3:12 to 12:12[2]

[2] See Detailed Layout Criteria for specific approved designs for each available roof pitch

NOTES

- Listings and approval as of printing.
- Listed to be utilized per NFPA 13 in conformance with the New Technology and Equivalency Sections.
- If a flat sloped ceiling is present utilizing non combustible insulation, the insulation must completely fill the pockets between the joists, and the insulation must be secured in place with metal wire netting or equivalent. The metal wire netting is intended to hold the insulation in place should the insulation become wetted by the operation of the sprinkler. Attic sprinklers have not been evaluated for use with spray foam insulation.

ALWAYS REFER TO ANY NOTIFICATIONS AT THE END OF THIS DOCUMENT REGARDING PRODUCT INSTALLATION, MAINTENANCE OR SUPPORT.

3.0 SPECIFICATIONS – MATERIAL

Deflector: Bronze

Bulb Nominal Diameter: 3.0 mm

Load Screw: Brass

Pip Cap: Brass

Spring Seal Assembly: PTFE coated Beryllium nickel alloy

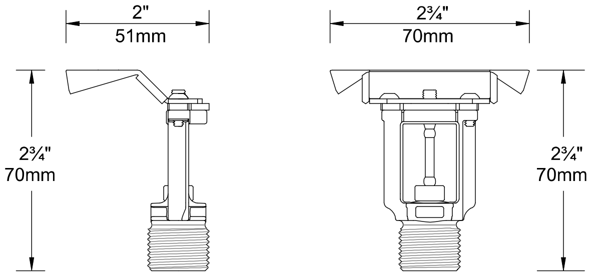
Frame: Brass

Lodgement Spring: Stainless steel

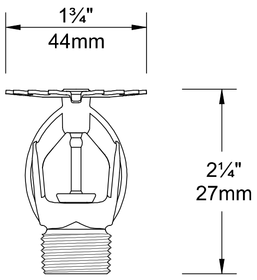
Installation Wrench: Ductile iron

Sprinkler Frame Finishes: Plain brass

4.0 DIMENSIONS



V5621



V5620

5.0 PERFORMANCE

Installation

The Specific Application Attic Sprinklers for Protecting Attics must be installed in accordance with this section. The FL-SA/RE and FL-SA/DS Specific Application Attic Sprinklers comprise an overall protection scheme which takes into account strategic positioning for activation sensitivity while providing unique distribution characteristics specifically designed for attic construction.

The protection methodology utilizing these sprinklers has been full scale fire tested in the built attic environment. As such, they must be installed in accordance with the guidelines set forth within this data sheet. The NFPA 13 Density/Area prescriptive spacing requirements do not apply as these sprinklers are not bound by the NFPA 13 "S x L Rules". The positioning and spacing requirements of this data sheet take precedence over any other prescriptive requirements that may exist in NFPA 13.

To install the Specific Application Attic Sprinklers, the following steps shall be taken:

Step 1. Sprinklers must be oriented correctly as follows:

- Series FL-SA/RE Sprinklers
  - At horizontal ridge (peak) – installed in the upright vertical position with deflector parallel to the ceiling below (i.e. sprinkler centerline perpendicular to the ridgeline).
  - Near eave or under hip type roofs – installed in the upright position with deflector parallel to roof deck (i.e. sprinkler centerline perpendicular to the roof slope).
- Series FL-SA/DS Sprinklers
  - These sprinklers are installed downslope from a ridgeline/peak (See FIGURE 7). Installed in the upright position with deflector parallel to roof deck (i.e. sprinkler centerline perpendicular to the roof slope). See FIGURE 2

Step 2. With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

NOTE
- Do not grasp the sprinkler by the deflector.

Step 3. Wrench-tighten the sprinkler using only the appropriate wrench. Wrenches are only to be applied to the sprinkler wrench flats or wrench hex, as applicable.

NOTE
- Do not apply wrench to frame arms.

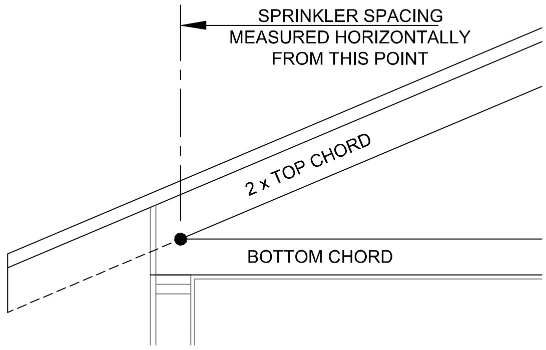


FIGURE 1A

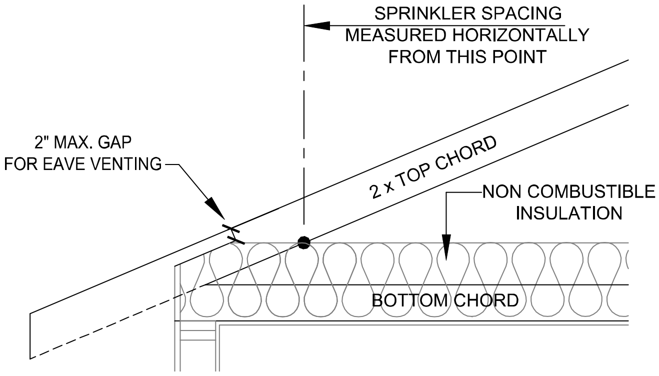


FIGURE 1B

FIGURE 1: DIMENSION FROM EAVE

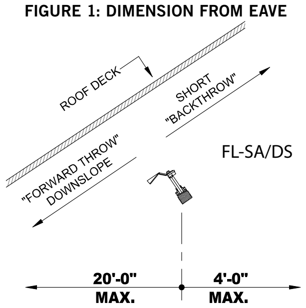


FIGURE 2: SPRINKLER FRAME ORIENTATION TO ROOF SLOPE

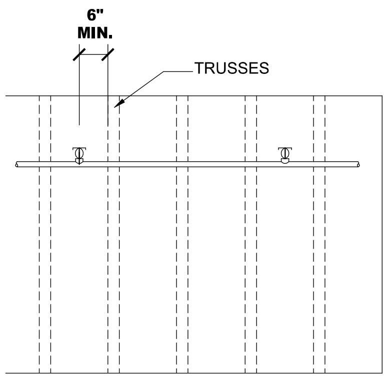


FIGURE 3: DIMENSION FROM TRUSS

5.0 PERFORMANCE (CONTINUED)

System Design Procedure

Gable Style Roof

Option 1: Ridge Sprinklers Only

- When utilizing this option Series FL-SA/RE sprinklers are used to protect the entirety of the attic space. The span of the attic is measured along the floor (or ceiling of floor below) of the attic space from the peak to the intersection of the bottom of the top chord of the roof joist and the non-combustible insulation or floor joist on the floor (or ceiling of floor below). The span is twice the longer of the two measured spans.
- The maximum span which can be protected by a single line of FL-SA/RE sprinklers at the peak is a total span of 24' or a maximum half span of 12'.

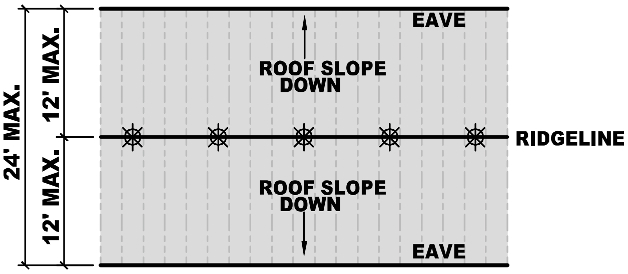


FIGURE 4A

Option 2: Ridgeline Sprinklers/Eave

Sprinklers (FL-SA/RE)

- This approach utilizes the FL-SA/RE sprinklers at the Ridgeline and downslope covering to the eave. (See FIGURE 6 for dimensional limitations)

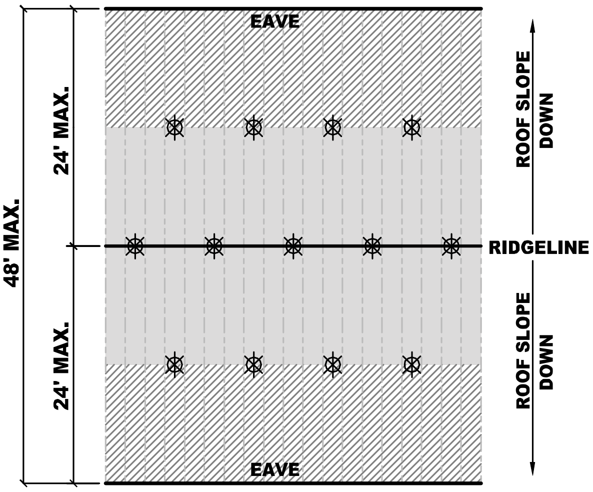


FIGURE 4B

Option 3: Ridgeline Sprinklers with Downslope

Sprinklers

- The maximum span of this approach is 72' or a half span of 36' as measured horizontally. (See FIGURE 6 and FIGURE 7 for dimensional limitations)

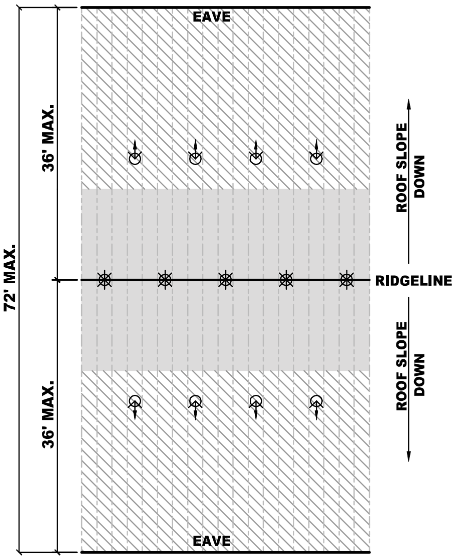


FIGURE 4C

 = Model FL-SA/RE

 = Model FL-SA/DS

FIGURE 4: GABLE SPRINKLER PLACEMENT OPTIONS

5.0 PERFORMANCE (CONTINUED)

Sprinkler Selection

Single Slope Roof Option 1:

FL-SA/DS Sprinklers at the Highpoint Only

- When utilizing this option, Model FL-SA/DS sprinklers are used to protect the entire width of the attic space from the eave to the vertical barrier of the single slope. The span of the attic is measured along the floor (or ceiling of floor below) of the attic space from the peak/vertical barrier to the intersection of the top chord and bottom chord of the roof trusses. See FIGURE 1.
- The maximum span that can be protected by a single line of FL-SA/DS sprinklers at the peak is 16' or 30' (measured horizontally from the sprinkler to eave).
- See FIGURE 11 for detailed sprinkler layout criteria.

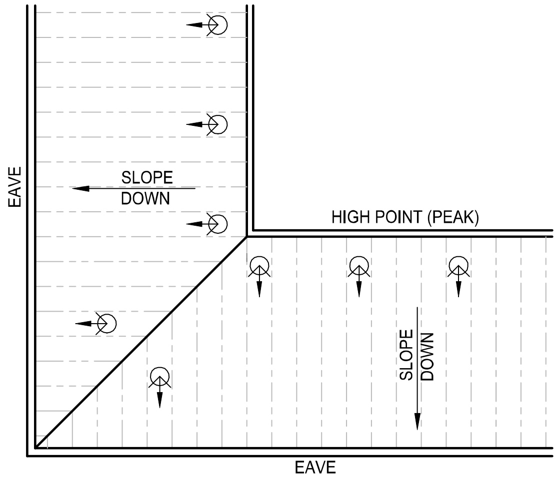


FIGURE 5A: 1 ROW SINGLE SLOPE CRITERIA

Single Slope Roof Option 2:

FL-SA/DS Sprinklers at the Highpoint and Downslope

- When utilizing this option, Model FL-SA/DS sprinklers are used to protect the entire width of the attic space from the eave to the vertical barrier of the single slope. The span of the attic is measured along the floor (or ceiling of floor below) of the attic space from the peak to the intersection of the top chord and bottom chord of the roof trusses. See FIGURE 1.
- The maximum span that can be protected by two lines of FL-SA/DS sprinklers at the peak is 29' + (depending on sprinkler placement).
- See FIGURE 11 for detailed sprinkler layout criteria.

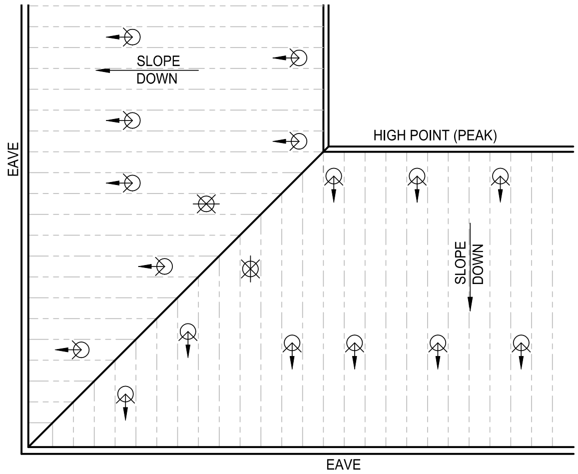
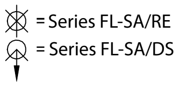


FIGURE 5B: 2 ROW SINGLE SLOPE

FIGURE 5: SINGLE SLOPE PROTECTION OPTIONS



5.0 PERFORMANCE (CONTINUED)

Ridgeline Design Criteria

Sprinkler Model

- FL-SA/RE

Slope

- 3:12 up to and including 6:12

Flow Rate

- 20 gpm

Distance Between Sprinklers Along Ridge

- Minimum 6'
- Maximum 8'

Minimum Distance to Downslope Sprinkler

- 6' (measured horizontally)

Maximum Distance to Downslope Sprinkler

- 16' (measured horizontally)

Deflector Distance Below Ceiling (At Ridgeline)

- Minimum 16"
- Maximum 24"

Deflector Distance Below Ceiling (When Downslope of Ridgeline)

- Install with deflector below bottom of top chord 1" minimum to 3" maximum.

Lateral Maximum Distance From Ridgeline

- 12"

Distance From Hip Peak

- Minimum 1'
- Maximum 4'

Installation

- When installed for Ridgeline protection, the FL-SA/RE Sprinkler has a zone of protection of 24' wide as measured horizontally across the ridgeline. The maximum zone of protection on either side of the ridgeline is 12' (as measured horizontally). The zone of protection along the ridgeline is 8' (4' maximum to either side of the FL-SA/RE Sprinkler).
- When a FL-SA/RE sprinkler is installed under a horizontal Ridge, the deflector is to be positioned parallel with the floor/ceiling below. (Regardless of allowed offset from directly below ridge)
- Maximum span for FL-SA/RE sprinkler to cover is 24' wide attic.
- Sprinklers must be installed with the frame arms parallel to the ridge.
- Centerline of sprinkler must be a minimum of 6" laterally from face of any truss. (see FIGURE 3)
- For obstruction criteria, see Obstruction section within this data sheet.
- When installed under a flat sloped ceiling (noncombustible insulation filled joist channels) maximum deflector to ceiling distance is the same as maximum distance below bottom of top chord or deflector distance below ridge.
- When spacing perpendicular to the slope under a smooth flat ceiling a minimum 2' lateral spacing perpendicular to the slope is required between sprinklers at the ridge and downslope sprinklers.

Hydraulic Calculations

- See Hydraulic Design Section

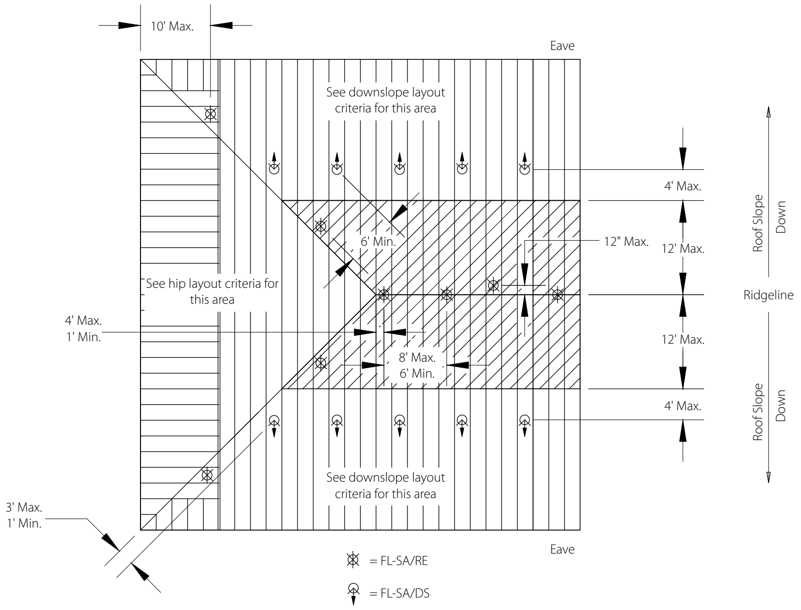


FIGURE 6: RIDGELINE LAYOUT CRITERIA

5.0 PERFORMANCE (CONTINUED)

Downslope Design Criteria

Sprinkler Model

- FL-SA/DS

Slope

- 3:12 up to and including 6:12

Flow Rate

- 20 gpm

Distance Between Sprinklers Perpendicular to Slope

- Minimum 4'
- Maximum 8'

Maximum Sprinkler Throw (measured horizontally)

- Upslope - 4'
- Downslope - 20'

Minimum Distance Between Sprinklers Downslope of the FL-SA/DS (Throw Direction)

- 15'

Deflector Distance Below Ceiling

- Install with deflector below bottom of top chord
- 1" minimum to 4" maximum.

Distance Away From Hip Line

- Minimum 1'
- Maximum 3'

Installation

- The FL-SA/DS Sprinkler has a zone of protection of 20' forward (measured on the horizontal); 4' backwards (measured on the horizontal; and 8' wide (4' laterally to either side of the sprinkler).
- Ensure that the sprinkler deflector is installed with the deflector parallel to the sloped roof above.
- Centerline of sprinkler must be a minimum of 6" laterally from face of truss (See FIGURE 3).
- Must be offset at least one channel laterally from any Ridgeline sprinkler or 2' minimum under smooth flat ceiling.
- Sprinklers must be installed with the frame arms perpendicular to the roof slope.
- For obstruction criteria, see Obstruction section within this data sheet.
- When installed under a flat sloped ceiling (noncombustible insulation filled joist channels) maximum deflector to ceiling distance is the same as maximum distance below bottom of top chord.
- When spacing perpendicular to the slope under a smooth flat ceiling a minimum 2' lateral spacing perpendicular to the slope is required between sprinklers at the ridge and downslope sprinklers.

Hydraulic Calculations

- See Hydraulic Design Section

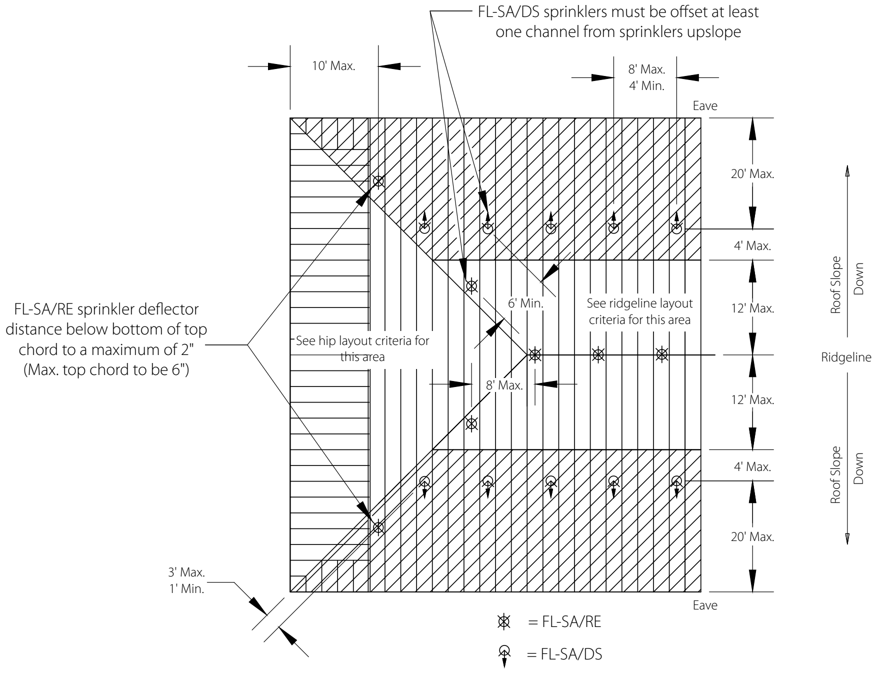
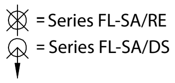


FIGURE 7: DOWNSLOPE LAYOUT CRITERIA



5.0 PERFORMANCE (CONTINUED)

Hip Area Sprinkler Design Criteria

Hip Truss/Jack Truss Construction

Sprinkler Model

- FL-SA/RE

Slope

- 3:12 up to and including 12:12

Flow Rate

- 20 gpm

Distance Between Sprinklers

First Row From Eave (measured horizontally)

- Minimum 6'
- Maximum 8'

Distance Between Sprinklers

All Other Rows Upslope (measured horizontally)

- Minimum 6'
- Maximum 12'

Distance From Eave To First Row (measured horizontally)

- Minimum 5'
- Maximum 12'

Distance Between Rows (measured horizontally)

- Minimum 6'
- Maximum 10'

Minimum Distance Between Sprinklers

- 6'

Deflector Distance Below Ceiling

- Install with deflector below bottom of top chord 1" minimum to 3" maximum.

Sprinkler At Apex

- A FL-SA/RE Sprinkler must be installed between 1' to 5' down from the intersection of the ridgeline and hip lines (Apex).

Sprinklers Adjacent To Hip Line

- All FL-SA/RE Sprinklers directly adjacent to hip line shall be 1' to 3' from hip line (as measured perpendicular to hip line).

Installation

- Ensure that the sprinkler is installed with the deflector parallel to the sloped roof above.
- Sprinklers must be installed with the frame arms perpendicular to the roof slope (see FIGURE 2).
- For obstruction criteria, see Obstruction section within this data sheet.
- When installed under a flat sloped ceiling (noncombustible insulation filled joist channels) maximum deflector to ceiling distance is the same as maximum distance below bottom of top chord.

Hydraulic Calculations

- See Hydraulic Design Section

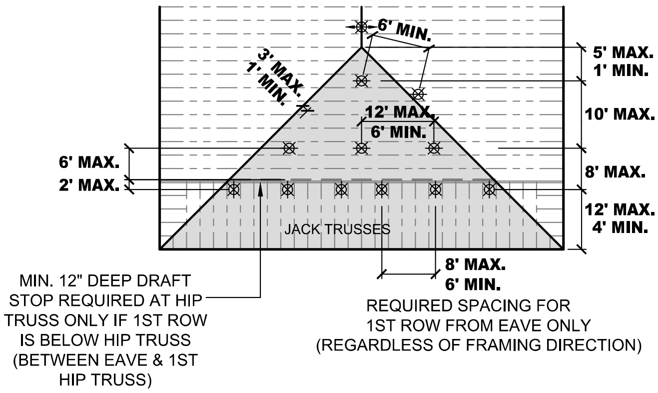


FIGURE 8A: HIP LAYOUT CRITERIA
WHEN FIRST ROW OF SPRINKLERS PLACED "WITHIN" JACK TRUSSES

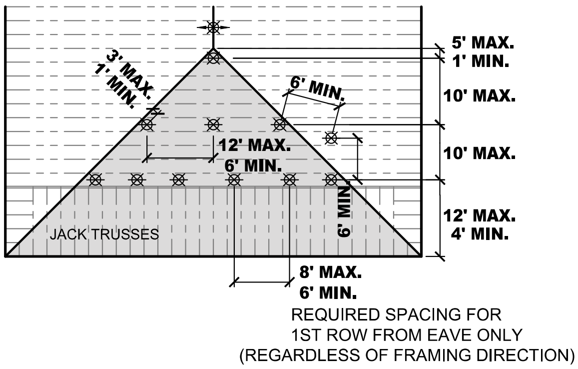
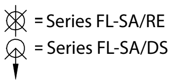


FIGURE 8B: HIP LAYOUT CRITERIA
WHEN FIRST ROW OF SPRINKLERS PLACED "BEYOND" JACK TRUSSES

FIGURE 8: HIP LAYOUT CRITERIA - HIP TRUSS/ JACK TRUSS CONSTRUCTION



5.0 PERFORMANCE (CONTINUED)

Hip Area Sprinkler Design Criteria

Framing Members Parallel to Roof Slope

Sprinkler Model

- FL-SA/RE

Slope

- 3:12 up to and including 12:12

Flow Rate

- 20 gpm

Distance From Eave to First Row (Measured Horizontally)

- Minimum 5'
- Maximum 12'

Maximum Distance Between Sprinklers

- See FIGURE 13

Deflector Distance Below Ceiling

- Install with deflector below bottom of top chord 1" minimum to 3" maximum.

Sprinkler at Apex

- A FL-SA/RE Sprinkler must be installed between 1' to 5' down from the intersection of the ridgeline and hip lines (Apex).

Sprinklers Adjacent To Hip Line

- All FL-SA/RE Sprinklers directly adjacent to hip line shall be 1' to 3' from hip line (as measured perpendicular to hip line).

Installation

- Ensure that the sprinkler is installed with the deflector parallel to the sloped roof above.
- Sprinklers must be installed with the frame arms perpendicular to the roof slope.
- For obstruction criteria, see Obstruction section within this data sheet.
- When installed under a flat sloped ceiling (noncombustible insulation filled joist channels) maximum deflector to ceiling distance is the same as maximum distance below bottom of top chord.

Hydraulic Calculations

- See Hydraulic Design Section

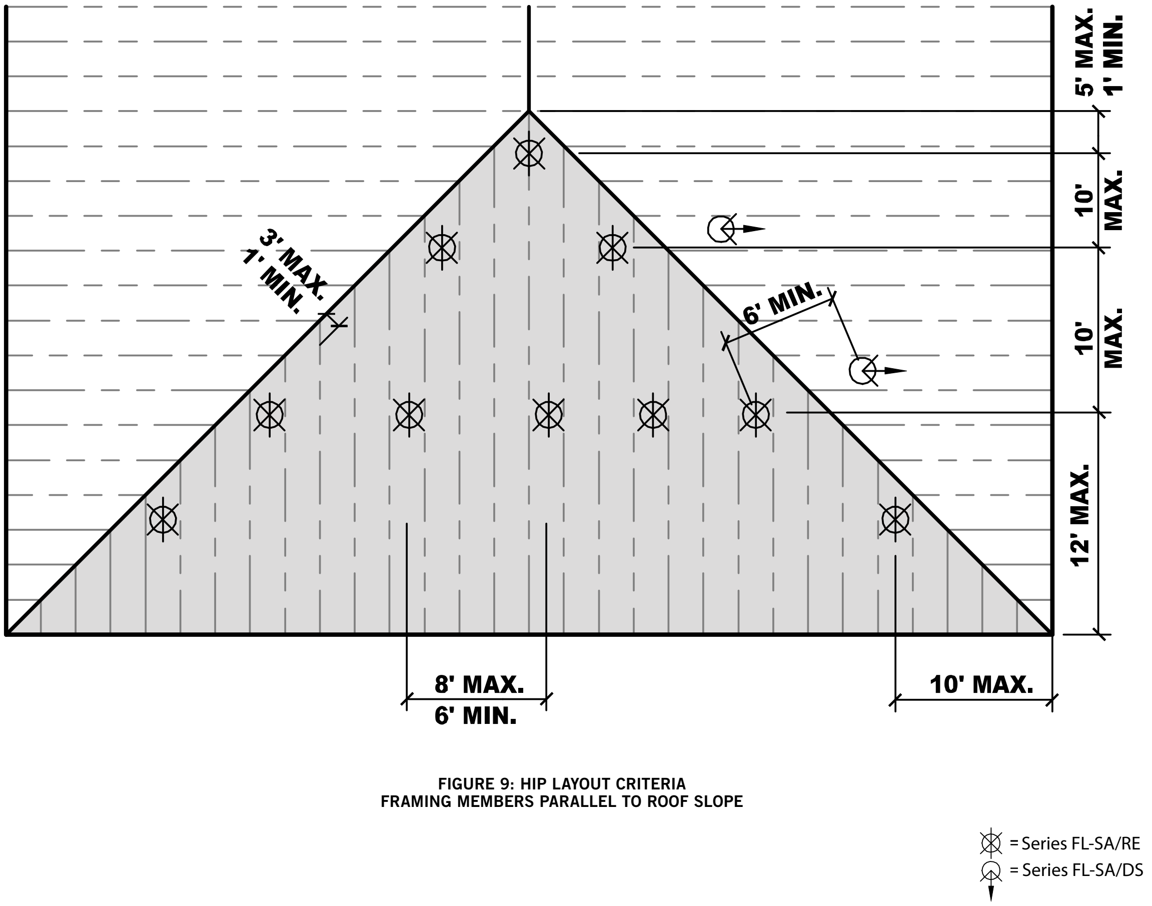


FIGURE 9: HIP LAYOUT CRITERIA
FRAMING MEMBERS PARALLEL TO ROOF SLOPE

5.0 PERFORMANCE (CONTINUED)

Hip Area Sprinkler Design Criteria

Framing Members Parallel to Roof Slope

Sprinkler Model

- FL-SA/DS (FL-SA/RE @ apex)

Slope

- 3:12 up to and including 12:12

Flow Rate

- 20 gpm

Distance Between Sprinklers (Laterally)

- Minimum 4'
- Maximum 8'

Distance From Eave To First Row (Measured Horizontally)

- Minimum 5'
- Maximum 20'

Deflector Distance Below Ceiling

- Install with deflector below bottom of top chord 1" minimum to 4" maximum.

Sprinkler At Apex

- A FL-SA/RE Sprinkler must be installed between 1' to 5' down from the intersection of the ridgeline and hip lines (Apex)

Sprinklers Adjacent To Hip Line

- All FL-SA/RE Sprinklers directly adjacent to hip line shall be 1' to 3' from hip line (as measured perpendicular to hip line)

Installation

- Ensure that the sprinkler is installed with the deflector parallel to the sloped roof above
- Sprinklers must be installed with the frame arms perpendicular to the roof slope.
- For obstruction criteria, see Obstruction section within this data sheet
- When installed under a flat sloped ceiling (noncombustible insulation filled joist channels) maximum deflector to ceiling distance is the same as maximum distance below bottom of top chord.

Hydraulic Calculations

- See Hydraulic Design Section

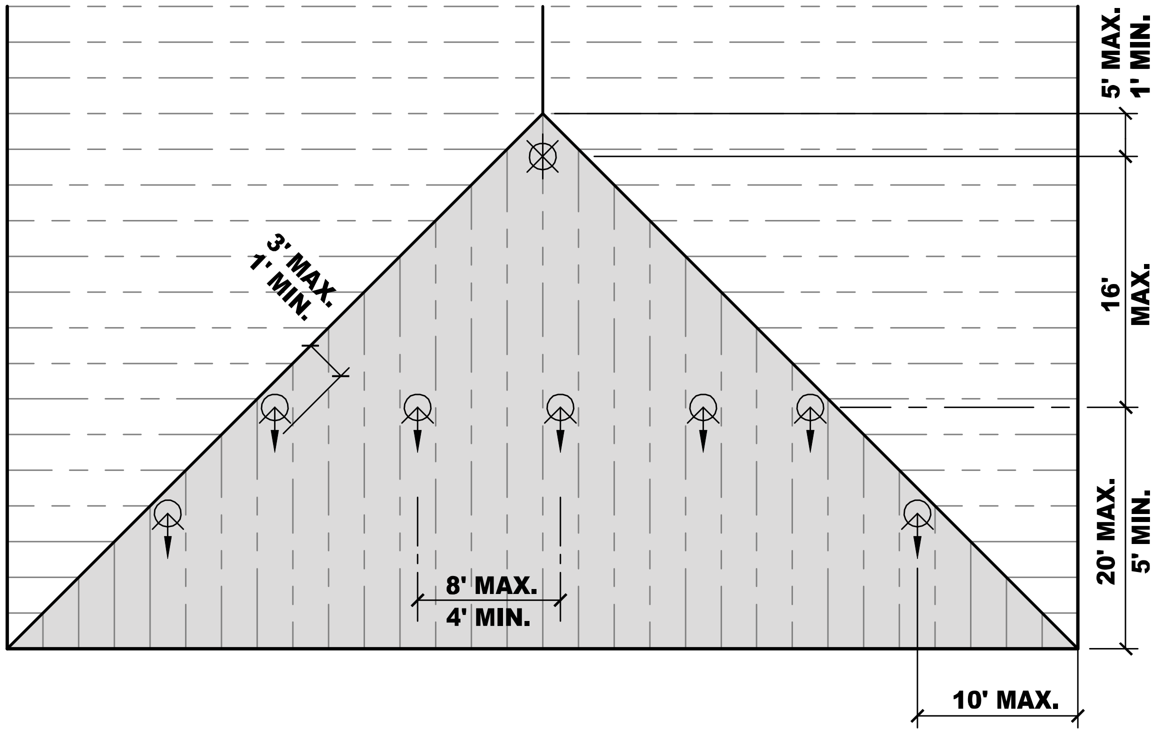
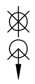


FIGURE 10: HIP LAYOUT CRITERIA
FRAMING MEMBERS PARALLEL TO ROOF SLOPE



5.0 PERFORMANCE (CONTINUED)

Single Slope Design Criteria

Sprinkler Model
- FL-SA/DS

Slope
- See Maximum Sprinkler Throw

Flow Rate
- 20 gpm Max Throw
- 26 gpm @ 30' Max Throw

NOTE
- See Max Sprinkler Throw Allowed

Deflector Distance Below Peak (See FIGURE 11A)
- Minimum 16".
- Maximum 24".

Deflector Distance Below Sloping Roof Deck (See Figure 11a)
- Install with deflector below bottom of top chord from 1" to a maximum of 4".

Distance Between Sprinklers Perpendicular to the Slope
- Minimum 4'
- Maximum 8'

Maximum Sprinkler Throw (Measured Horizontally)
- Downslope - 16' @ 20 gpm (3:12 to 12:12)
- >16' up to 30' @ 26 gpm (4:12 to 12:12- 1 row application only)

Minimum Distance Between Sprinklers Downslope Of The FL-SA/DS (Throw Direction)
- 15' (as measured on the slope)
- Note: 15' min not required if ≥ 4' lateral between sprinklers

Installation
- Ensure that the sprinkler deflector is installed with the deflector parallel to the sloped roof above.
- Centerline of sprinkler must be a minimum of 6" laterally from face of truss. See FIGURE 3.
- When two rows of FL-SA/DS sprinklers are utilized, the adjacent rows of sprinklers must be offset at least one channel laterally from each other or 2' min under smooth flat ceiling. See FIGURE 11C.
- Sprinklers must be installed with the frame arms perpendicular to the roof slope. See FIGURE 2.
- For obstruction criteria, see Obstruction section within this data sheet.
- When installed under a flat sloped ceiling (noncombustible insulation filled joist channels) maximum deflector to ceiling distance is the same as maximum distance below bottom of top chord.

Hydraulic Calculations
- See Hydraulic Design Section

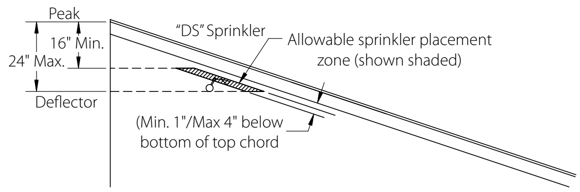


FIGURE 11A - SECTION VIEW DS SPRINKLER & DEFLECTOR PLACEMENT AT PEAK

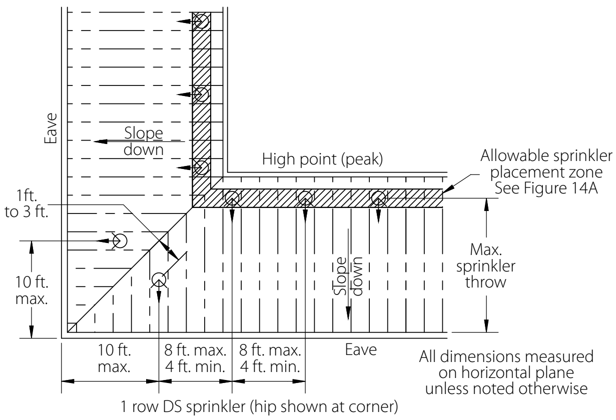


FIGURE 11B - 1 ROW DS SPRINKLER (HIP SHOWN AT CORNER)

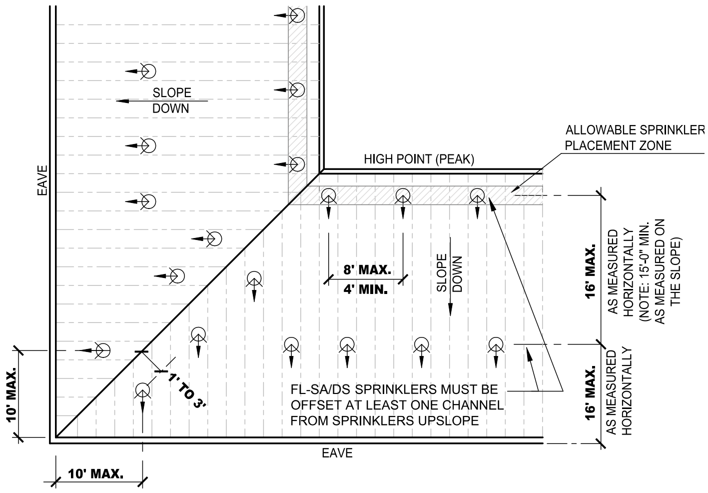


FIGURE 11C - 2 ROW DS SPRINKLER (HIP SHOWN AT CORNER)

FIGURE 11: SINGLE SLOPE LAYOUT CRITERIA

5.0 PERFORMANCE (CONTINUED)

Dormer Protection Criteria

The protection scheme for dormer roofs shall be in accordance with the following guidelines:

Dormers Built Entirely Over (on top) of Main Roof Sheathing – 4 Sprinklers or Less – Any Slope

- RE/DS Sprinklers allowed (CPVC allowance applies for wet systems only)
- Standard Spray Sprinklers allowed

Dormers Built Entirely Over (on top) of Main Roof Sheathing - More than 4 Sprinklers

- RE/DS Sprinklers allowed where the pitch is between 3:12 and 6:12. Protection scheme utilized shall be in accordance with this document
- Standard Spray Sprinklers allowed for any slope

Dormers Open to Attic Space Below – 4 Sprinklers or Less – Any Slope

- RE/DS Sprinklers allowed (CPVC allowance applies for wet systems only)
- Standard Spray Sprinklers allowed.

Dormers Open to Attic Space Below - More than 4 Sprinklers

- RE/DS Sprinklers allowed where the pitch is between 3:12 and 6:12. Protection scheme utilized shall be in accordance with this document
- Standard Spray Sprinklers allowed for any slope. (Required to calculate Attic in accordance with NFPA 13 (i.e. 2535 sq.' for Dry Systems)

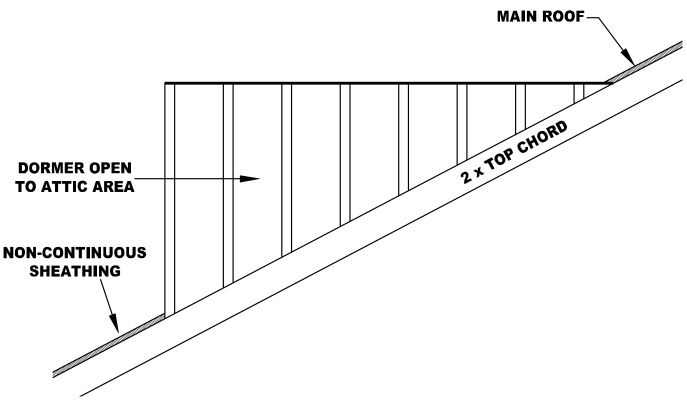


FIGURE 12A
DORMER OPEN TO ATTIC SPACE

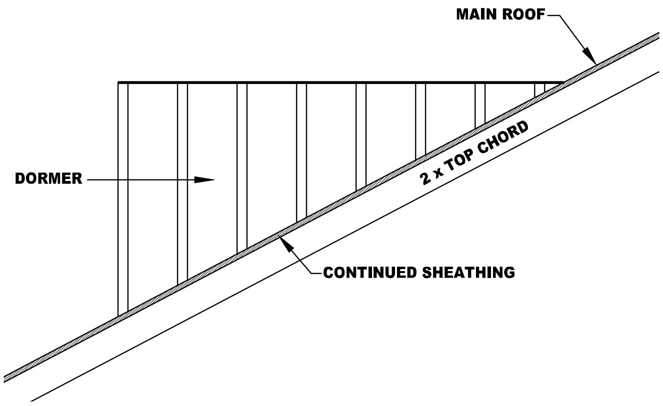


FIGURE 12B
DORMER ENTIRELY OVER MAIN ROOF SHEATHING

FIGURE 12: DORMERS SECTION VIEW

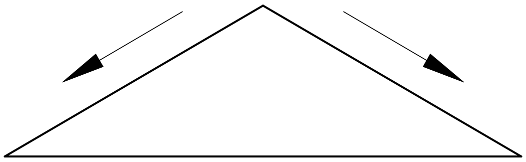
5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

The Specific Application Attic protection scheme shall be hydraulically calculated in accordance with the following guidelines. These calculation guidelines are applicable only to the special Attic Protection scheme utilizing FL-SA/RE and FL-SA/DS sprinklers. These requirements are based on special full scale fire testing and in no way should be utilized when designing other than these specially listed and tested sprinklers for use in sloped combustible attic structures.

As with Hydraulic Calculations performed in accordance with NFPA 13, multiple areas of piping may need to be investigated and multiple calculations performed should it not be readily obvious of the hydraulically most demanding area due to non-typical pipe layout. Hose allowances must be included in the hydraulic calculations in accordance with NFPA 13.

GABLE ROOF CALCULATION PROCEDURE



3 BRANCHLINE DESIGN - WET SYSTEM

3 Branchline Design – Wet System

Perform the following 2 calculations:

Calculation #1: Calculate the 5 most hydraulically demanding sprinklers consisting of 5 FL-SA/RE (Ridgeline) sprinklers. Minimum sprinkler flow is 20 gpm per sprinkler. See FIGURE 13A.

Calculation #2: Calculate the 5 most hydraulically demanding sprinklers consisting of 2 FL-SA/DS (Downslope) sprinklers and 3 FL-SA/RE (Ridgeline) sprinklers. Minimum sprinkler flow is 20 gpm per sprinkler. See FIGURE 13B.

Note: If additional sprinklers are required beyond an obstruction, calculate up to 2 additional sprinklers beyond the obstruction. See FIGURE 13B.

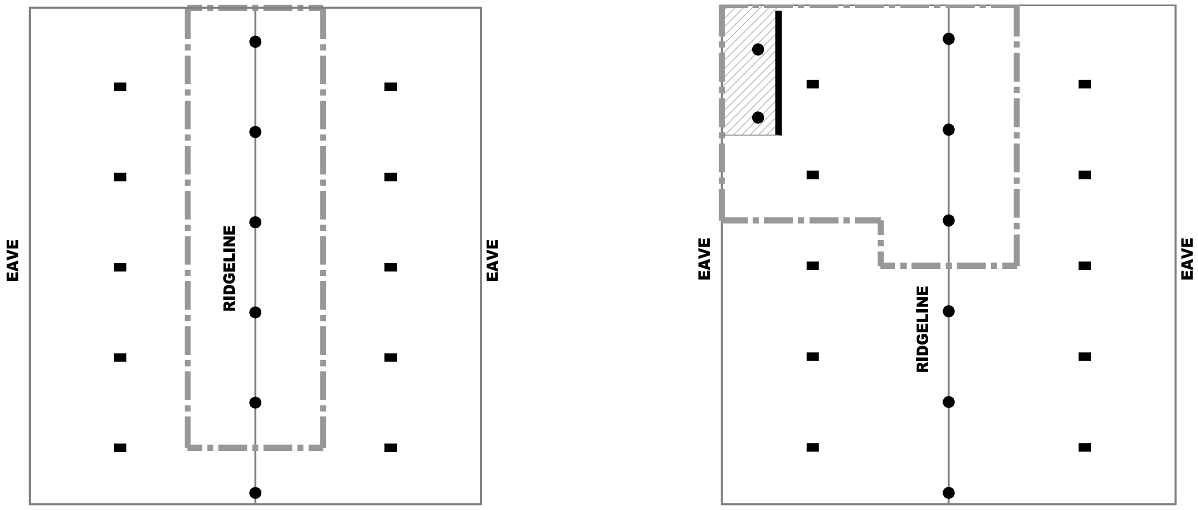


FIGURE 13A
DORMER OPEN TO ATTIC SPACE

FIGURE 13B
2 ROW DS SPRINKLER
(HIP SHOWN AT CORNER)

FIGURE 13: HYDRAULIC CALCULATION REQUIRED FOR WET 3 BRANCHLINE SYSTEM

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

3 Branchline Design - Dry System

Perform the following 2 calculations:

Calculation #1: Calculate the 6 most hydraulically demanding sprinklers consisting of 6 FL-SA/RE (Ridgeline) sprinklers. Minimum sprinkler flow is 20 gpm per sprinkler. See FIGURE 14A.

Calculation #2: Calculate the 6 most hydraulically demanding sprinklers consisting of 2 FL-SA/DS (Downslope) sprinklers and 4 FL-SA/RE (Ridgeline) sprinklers. Minimum sprinkler flow is 20 gpm per sprinkler. See FIGURE 14B.

Note: If additional sprinklers are required beyond an obstruction, calculate up to 2 additional sprinklers beyond the obstruction. See FIGURE 14B.

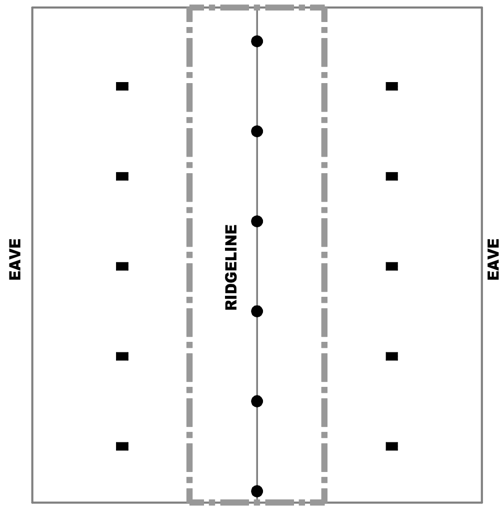


FIGURE 14A

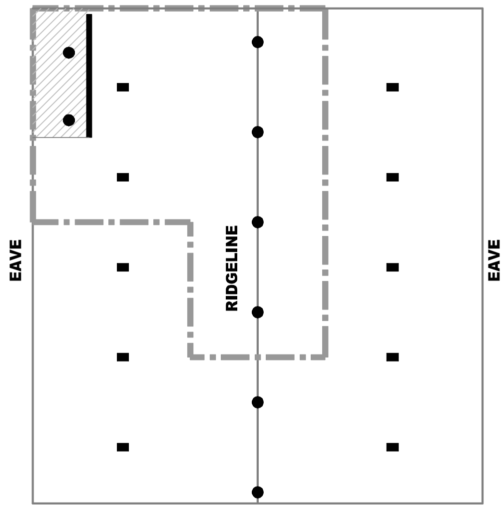


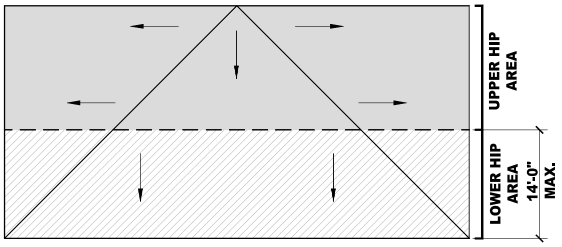
FIGURE 14B

FIGURE 14: HYDRAULIC CALCULATIONS REQUIRED FOR DRY 3 BRANCHLINE SYSTEM

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

Hip Roof Calculation Procedure



When a Hip is included in the design of the attic, there are three calculations required. One calculation for the "Ridge/Hip Transition" area. The second and third calculations determine the pipe sizing for the Hip area itself. For the purposes of these hydraulic calculations the Hip is broken into two areas; the "Lower Hip" area; and the "Upper Hip" area. See above figure.

Hip Calculation (Hip Truss/Jack Truss Construction) - Wet System

Calculation #1 – Ridge/Hip Transitions

- Calculate the most demanding 7 contiguous sprinklers with a maximum of 5 sprinklers along the ridge plus the 2 most demanding sprinklers within the hip area. See FIGURE 15A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Calculation #2 – Lower Hip Area

- Calculate up to the 7 most demanding contiguous sprinklers along the eave. This may include sprinklers on both sides of the hip line as shown. See FIGURE 15B.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Calculation #3 – Upper Hip Area

If there are 4 sprinklers or less in the shaded area (FIGURE 15B):

- Calculate up to the 7 most demanding contiguous sprinklers in the "Upper Hip" area. This may include sprinklers on both sides of the hip line as shown.
- Minimum sprinkler flow is 20 gpm per sprinkler.

If there are more than 4 sprinklers in the shaded area (FIGURE 15C):

- Calculate the hydraulically most demanding 75% of the total number of sprinklers located within the "Upper Hip" area, rounding up to the nearest sprinkler. (Minimum number of sprinklers to be calculated is 7)
- Minimum sprinkler flow is 20 gpm per sprinkler.

– Example shown in FIGURE 15C results in 9 sprinklers to be calculated. (12 x 0.75 = 9)

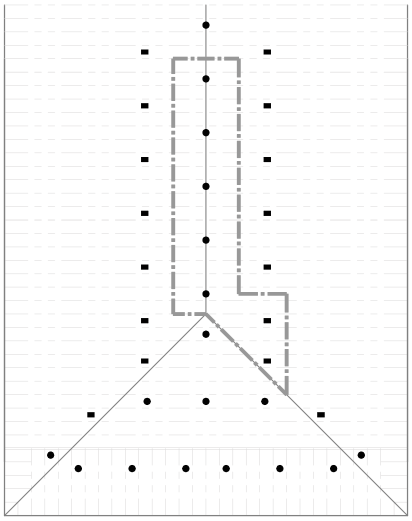


FIGURE 15A

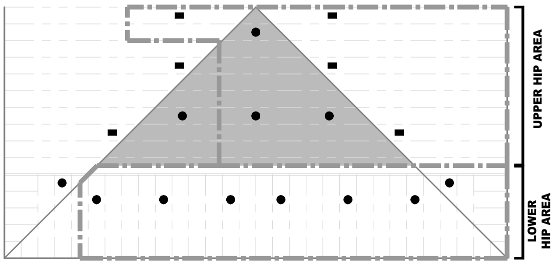


FIGURE 15B

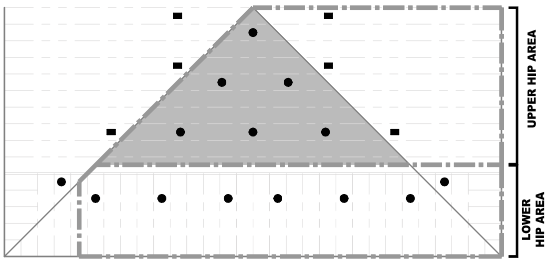


FIGURE 15C

FIGURE 15: HYDRAULIC CALCULATIONS REQUIRED FOR HIP - WET SYSTEM (HIP TRUSS/JACK TRUSS CONSTRUCTION)

● = RE

■ = DS

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

Hip Calculation (Hip Truss/Jack Truss Construction - Dry System)

Calculation #1 – Ridge/Hip Transitions

- Calculate the most demanding 8 contiguous sprinklers with a maximum of 6 sprinklers along the ridge plus the 2 most demanding sprinklers within the hip area. See FIGURE 16A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Calculation #2 – Lower Hip Area

- Calculate the 8 most demanding contiguous sprinklers along the eave. This may include sprinklers on both sides of the hip line as shown. See FIGURE 16B.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Calculation #3 – Upper Hip Area

If there are 4 sprinklers or less in the shaded area (FIGURE 16B):

- Calculate up to the 8 most demanding contiguous sprinklers in the "Upper Hip" area. This may include sprinklers on both sides of the hip line as shown. See FIGURE 16B.
- Minimum sprinkler flow is 20 gpm per sprinkler.

If there are more than 4 sprinklers in the shaded area (FIGURE 16C):

- Calculate all sprinklers in the "Upper Hip" area.
- Minimum sprinkler flow is 20 gpm per sprinkler.

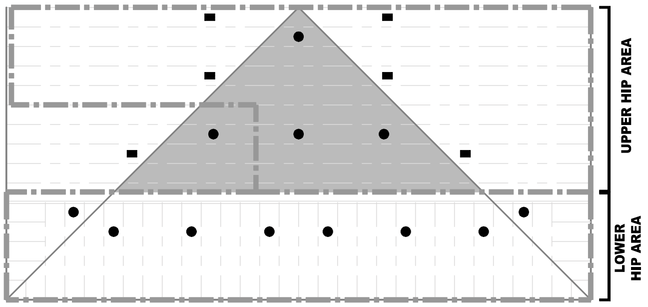


FIGURE 16B

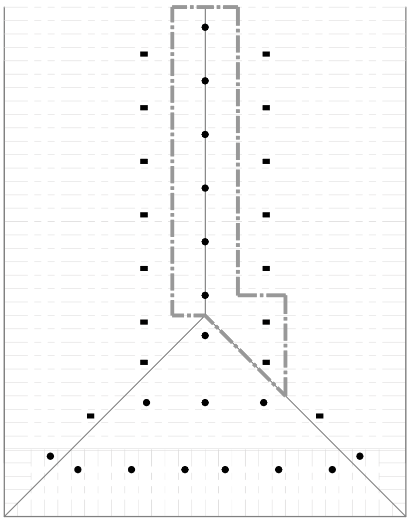


FIGURE 16A

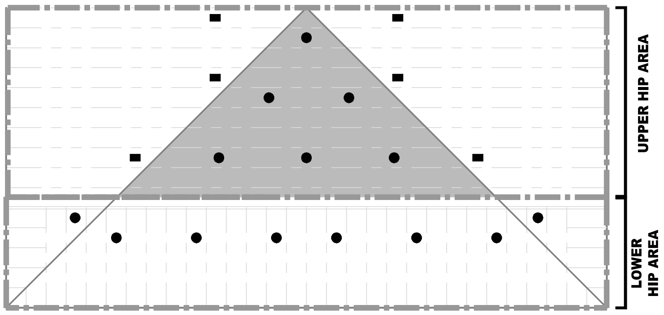


FIGURE 16C

FIGURE 16: HYDRAULIC CALCULATIONS REQUIRED FOR HIP - DRY SYSTEM
(HIP TRUSS/JACK TRUSS CONSTRUCTION)

● = RE

■ = DS

(Examples shown in these figures are for reference only. Actual sprinklers selected based on piping configuration which results in the most demanding hydraulic demand.)

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

Hip Calculation RE Sprinklers (Framing Members Parallel To Roof Slope) - Wet System

Calculation #1 – Ridge/Hip Transitions

- Calculate the most demanding 7 contiguous sprinklers with a maximum of 5 sprinklers along the ridge plus the 2 most demanding sprinklers within the hip area. See FIGURE 15A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Calculation #2 – Hip Area

- Calculate all sprinklers within the hip area shown shaded. See FIGURE 20.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Hip Calculation RE Sprinklers (Framing Members Parallel To Roof Slope) - Dry System

Calculation #1 – Ridge/Hip Transitions

- Calculate the most demanding 8 contiguous sprinklers with a maximum of 6 sprinklers along the ridge plus the 2 most demanding sprinklers within the hip area. See FIGURE 16A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Calculation #2 – Hip Area

- Calculate all sprinklers within the hip area shown shaded. See FIGURE 17.
- Minimum sprinkler flow is 20 gpm per sprinkler.

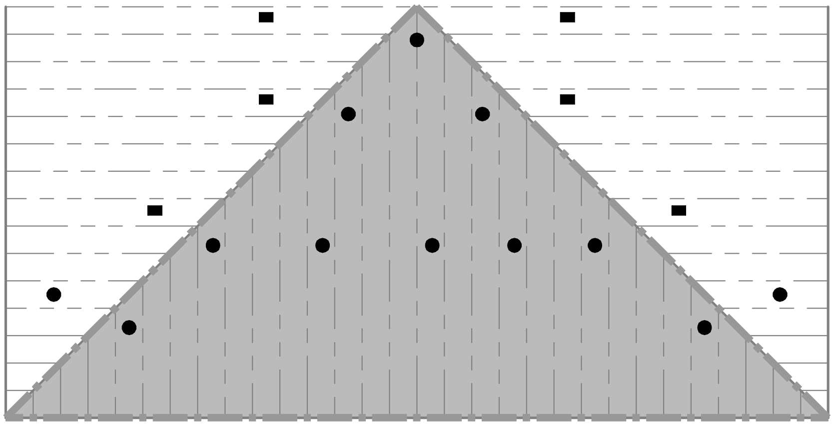


FIGURE 17: HYDRAULIC CALCULATIONS REQUIRED FOR RE @ HIP (FRAMING MEMBERS PARALLEL TO SLOPE)

● = RE

■ = DS

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

Hip Calculation DS Sprinklers (Framing Members Parallel To Roof Slope) - Wet System

Calculation #1 – Ridge/Hip Transitions

- Calculate the most demanding 7 contiguous sprinklers with a maximum of 5 sprinklers along the ridge plus the 2 most demanding sprinklers within the hip area. See FIGURE 15A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Calculation #2 – Hip Area

- Calculate all sprinklers within the hip area shown shaded. See FIGURE 18A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Hip Calculation DS Sprinklers (Framing Members Parallel To Roof Slope) - Dry System

Calculation #1 – Ridge/Hip Transitions

- Calculate the most demanding 8 contiguous sprinklers with a maximum of 6 sprinklers along the ridge plus the 2 most demanding sprinklers within the hip area. See FIGURE 16A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Calculation #2 – Hip Area

- Calculate all sprinklers within the hip area shown shaded. See FIGURE 18A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

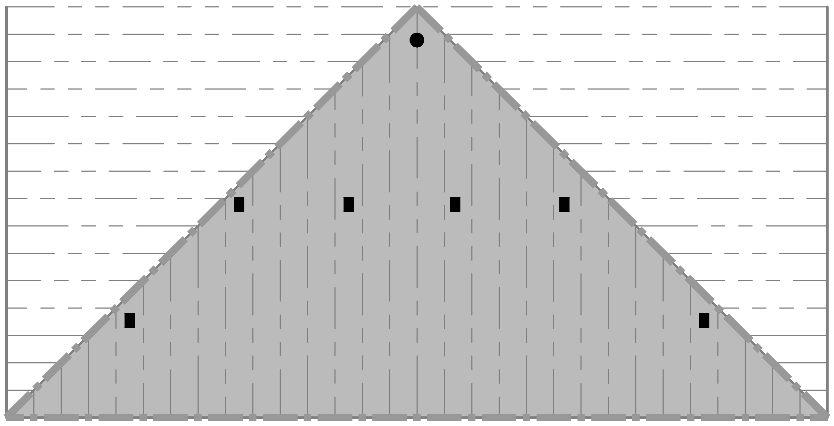


FIGURE 18A: HYDRAULIC CALCULATIONS REQUIRED FOR DS @ HIP
(FRAMING MEMBERS PARALLEL TO SLOPE)

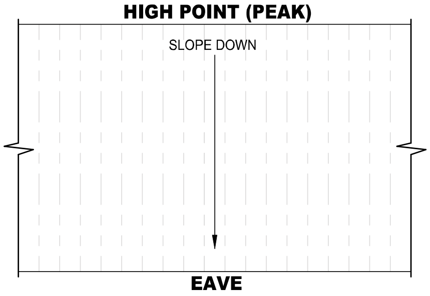
● = RE

■ = DS

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

Single Slope Roof Calculation Procedure



When a single slope roof area exists, the following calculation procedures shall be followed to size piping to the sprinklers protecting this area. NOTE: Single Slopes (with vertical shear walls) result in different fire dynamics than might be seen with gable and/or hip roof construction.

Single Slope Roof Calculation - Wet System

1: Row Protection

- Calculate the most hydraulically demanding 5 contiguous DS sprinklers. See FIGURE 19A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

2: Row Protection

The following 2 sets of calculations shall be performed:

- Calculation #1: Calculate the most hydraulically demanding 5 contiguous sprinklers consisting of 3 at the high point and 2 on the adjacent slope. See FIGURE 19B.
- Calculation #2: Calculate the most hydraulically demanding 5 contiguous sprinklers along the high point. See FIGURE 19C.
- Minimum sprinkler flow is 20 gpm per sprinkler or 26 gpm per sprinkler (depending on sprinkler throw).

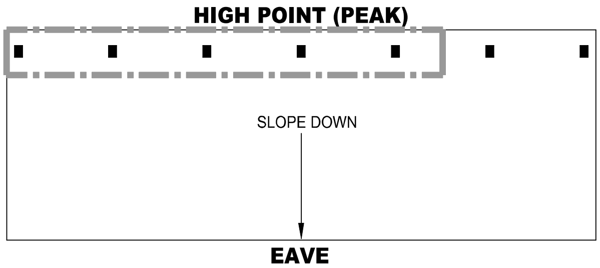


FIGURE 19A
1 ROW PROTECTION CALCULATION

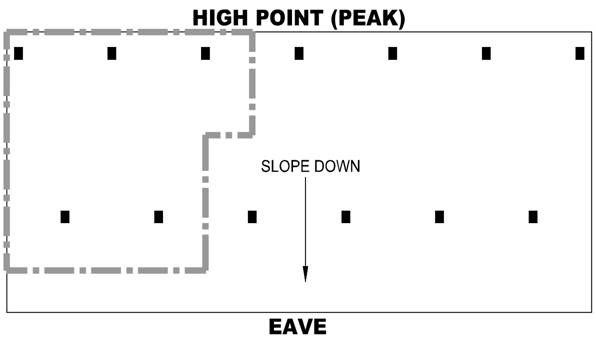


FIGURE 19B
2 ROW PROTECTION CALCULATION #1

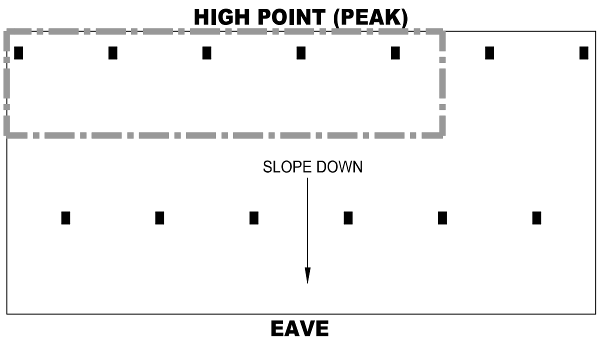


FIGURE 19C
2 ROW PROTECTION CALCULATION #2

FIGURE 19: HYDRAULIC CALCULATIONS REQUIRED FOR WET SYSTEM
SINGLE SLOPE DESIGN

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

Single Slope Roof Calculation Procedure

Single Slope Roof Calculation - Dry System

1: Row Protection

- Calculate the most hydraulically demanding 7 contiguous DS sprinklers. See FIGURE 20A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

2: Row Protection

The following 2 sets of calculations shall be performed:

- Calculation #1: Calculate the 7 most hydraulically demanding contiguous DS sprinklers located along the high point (peak). See FIGURE 20B.
- Calculation #2: Calculate the 7 most hydraulically contiguous DS sprinklers consisting of 5 DS at the hight point (peak) and 2 DS sprinklers on the adjacent downslope branchline. See FIGURE 20C.
- Minimum sprinkler flow is 20 gpm per sprinkler.

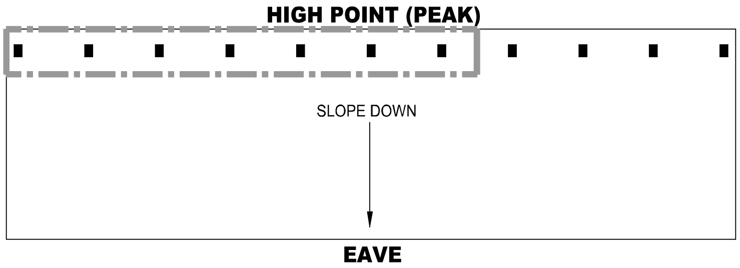


FIGURE 20A
1 ROW PROTECTION CALCULATION #1

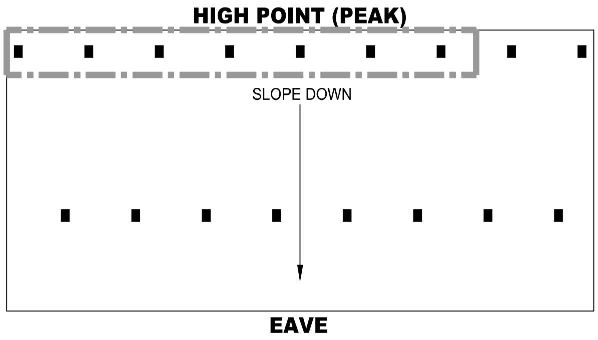


FIGURE 20B
1 ROW PROTECTION CALCULATION

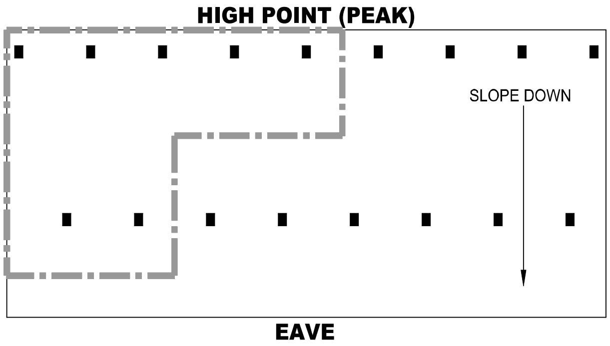


FIGURE 20C
1ROW PROTECTION CALCULATION #2

FIGURE 20: HYDRAULIC CALCULATIONS REQUIRED FOR DRY SYSTEM
SINGLE SLOPE DESIGN

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

Single Slope Roof With Hip Calculation Procedure

Single Slope Roof Calculation - Wet System

1: Row Protection

- Calculate the 5 most hydraulically demanding contiguous DS sprinklers located along the high point plus the 2 most demanding sprinklers along the hip line. See FIGURE 21A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

2: Row Protection

The following 3 sets of calculations shall be performed:

- Calculation #1: Calculate the 3 most hydraulically demanding contiguous DS sprinklers located along the high point (peak) plus the 2 most demanding sprinklers along the hip line. See FIGURE 21B.
- Calculation #2: Calculate the most hydraulically demanding 5 contiguous sprinklers along the high point. See FIGURE 21C.
- Calculation #3: Calculate all sprinklers within the shaded corner Hip area as shown. See FIGURE 21D.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Note: The "plus 2" most demanding sprinklers along the hip line may vary from that shown in the figures depending on actual piping. Designer may need to investigate multiple options to determine the 2 most demanding sprinklers to incorporate into the calculations.

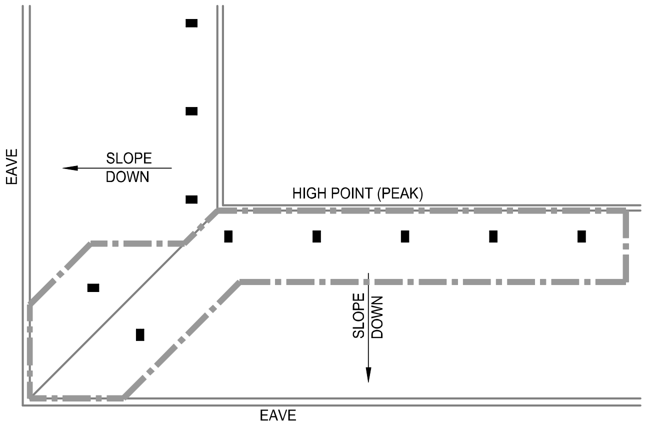


FIGURE 21A: 1 ROW PROTECTION CALCULATION

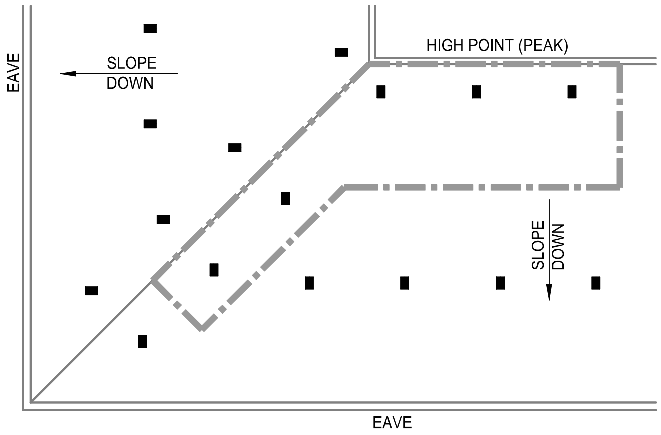


FIGURE 21B: 2 ROW PROTECTION CALCULATION #1

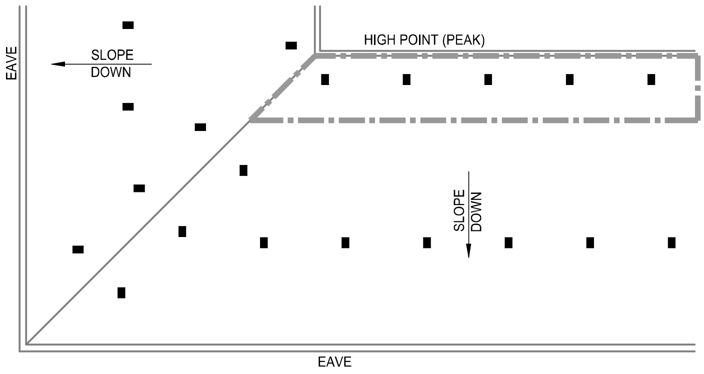


FIGURE 21C: 2 ROW PROTECTION CALCULATION #2

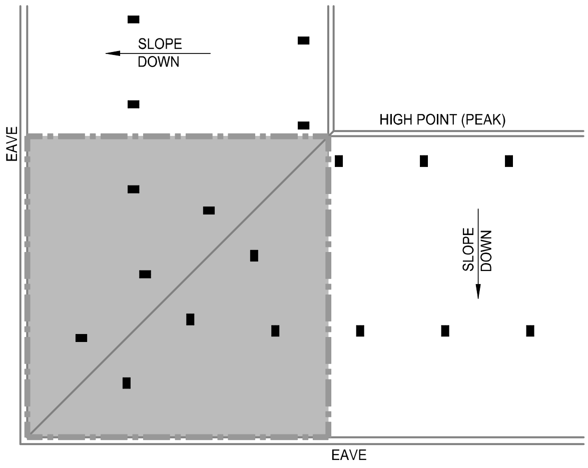


FIGURE 21D: 2 ROW PROTECTION CALCULATION #3

FIGURE 21: SINGLE SLOPE DESIGN

5.0 PERFORMANCE (CONTINUED)

Hydraulic Design

Single Slope Roof With Hip Calculation Procedure

Single Slope Roof Calculation - Dry System

1 Row Protection

- Calculate the 7 most hydraulically demanding contiguous DS sprinklers located along the high point plus the 2 most demanding sprinklers along the hip line. See FIGURE 22A.
- Minimum sprinkler flow is 20 gpm per sprinkler.

2 Row Protection

The following 2 sets of calculations shall be performed:

- Calculation #1: Calculate the 7 most hydraulically demanding contiguous DS sprinklers located along the high point (peak) plus the 2 most demanding sprinklers along the hip line. See FIGURE 22B.
- Calculation #2: Calculate all sprinklers within the shaded corner Hip area as shown. See FIGURE 22C.
- Minimum sprinkler flow is 20 gpm per sprinkler.

Note: The "plus 2" most demanding sprinklers along the hip line may vary from that shown in the figures depending on actual piping. Designer may need to investigate multiple options to determine the 2 most demanding sprinklers to incorporate into the calculations.

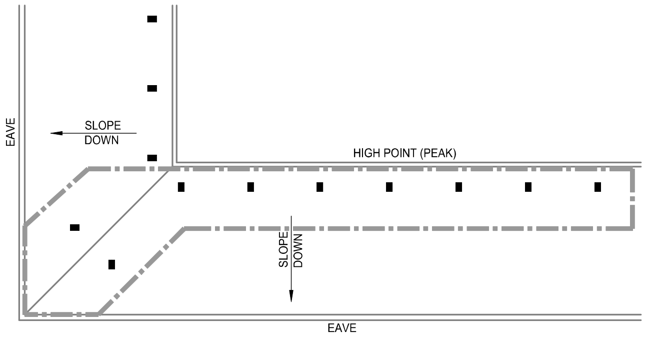


FIGURE 22A: 1 ROW PROTECTION CALCULATION

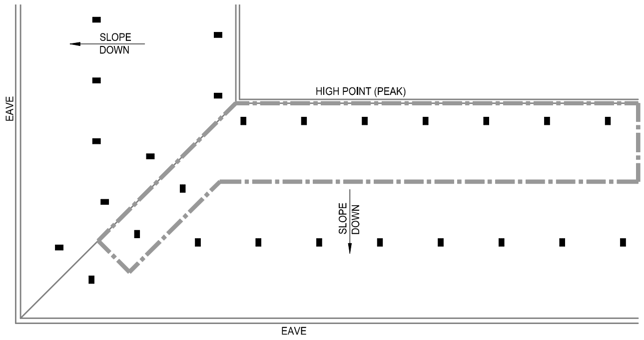


FIGURE 22B: 2 ROW PROTECTION CALCULATION #1

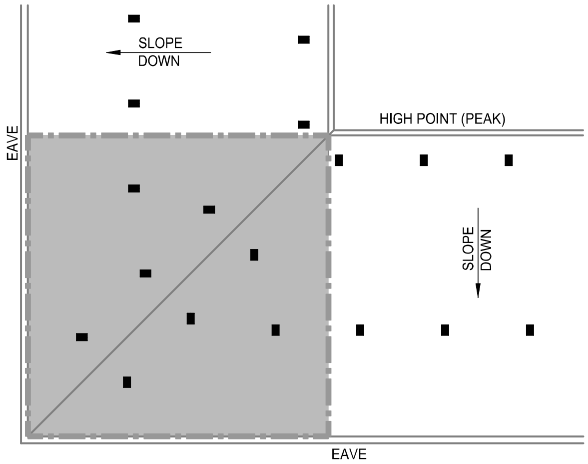


FIGURE 22C: 2 ROW PROTECTION CALCULATION #2

FIGURE 22: SINGLE SLOPE DESIGN

5.0 PERFORMANCE (CONTINUED)

Obstructions

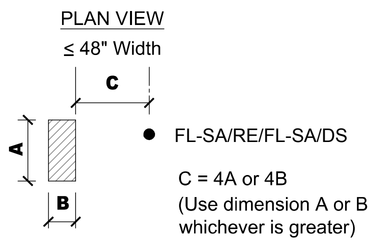
The following guidelines outline criteria to minimize critical obstructions to spray pattern development and to maximize effectiveness in achieving control.

General

- Structural trusses and web members are not considered "obstructions" provided a minimum 6" lateral distance from sprinklers to side of truss/web member is maintained.
- FL-SA/RE and FL-SA/DS sprinklers may be installed directly on maximum nominal 2½" (DN65) pipe without the need for a "Sprig-up". For pipe larger than 2½" nominal, see NFPA 13 for Sprig requirements.
- Sprinklers shall be positioned away from obstructions a minimum distance of Four (4) times the maximum dimension of the obstruction (e.g. Ducts, pipe). This 4X requirement does not apply to truss web members provided the web members do not exceed 6" and the minimum lateral distance of 6" from sprinkler to side of member is maintained.

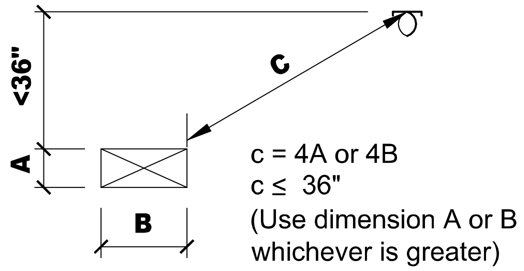
Obstruction criteria is otherwise grouped into three categories (See FIGURE 23, FIGURE 24 and FIGURE 25)

- **Vertical Obstructions**
  Those obstructions which run vertically through the attic. These may consist of fireplace flues, walls, vents, stacks, etc. These obstructions will typically run up to or penetrate the roof deck.
- **Suspended Horizontal Obstructions**
  Those obstructions which are typically "suspended" within the attic space itself and run horizontally. These obstructions will have clearance over and under the obstruction to allow discharge of water around the obstruction. These obstructions may consist of ductwork; walkways; etc. Horizontal obstructions located within 1'-0" vertically of the bottom chords or ceiling joists are not considered "Suspended" Horizontal Obstructions.
- **Obstructions at Upper Deck**
  Those obstructions which are either attached directly to the roof deck or to the top chords/joists of the roof framing in a manner that little to no discharge of water can pass/clear the top of the obstruction. These obstructions can have an impact on the upper portion of the spray pattern from sprinklers.



Should the sprinkler not be able to be located a distance of 4X away from obstruction, an additional sprinkler must be installed on the opposite side of the obstruction within 1'-0" from the opposite side of the obstruction.

FIGURE 23: VERTICAL OBSTRUCTIONS FL-SA/RE/FL-SA/DS SPRINKLERS



No additional sprinkler required below, if equal to or less than 48" suspended obstruction.

FIGURE 24A

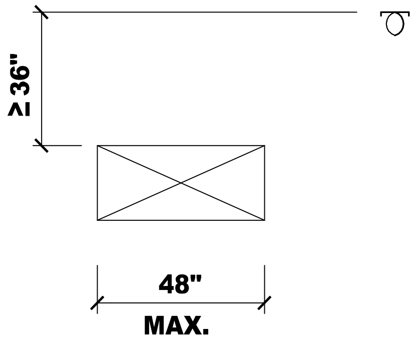
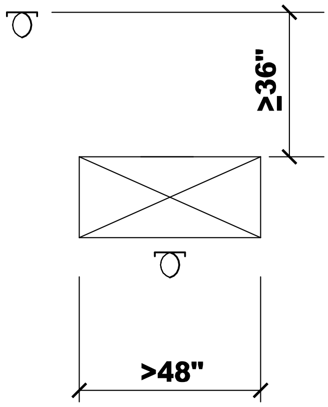


FIGURE 24B

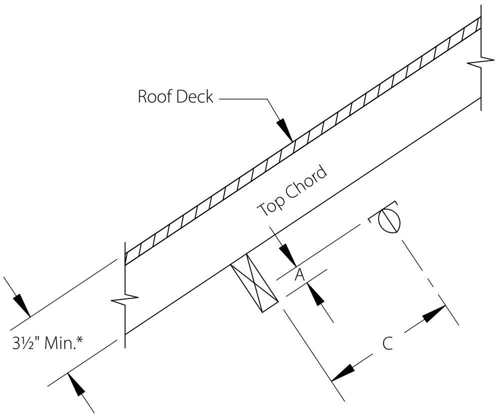


Additional sprinkler required below, if greater than 48" suspended obstruction.

FIGURE 24C

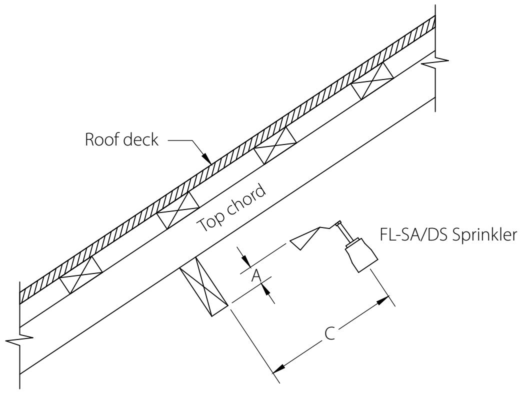
FIGURE 24: SUSPENDED HORIZONTAL OBSTRUCTIONS FL-SA/RE/FL-SA/DS SPRINKLERS

5.0 PERFORMANCE (CONTINUED)



DISTANCE FROM SPRINKLER TO SIDE OF OBSTRUCTION C inches (mm)	MAXIMUM ALLOWABLE DISTANCE OF DEFLECTOR ABOVE BOTTOM OF OBSTRUCTION A inches (mm)
Less than 1' 6". (457mm)	NOT ALLOWED
1' 6". (457mm) to less than 3' 0". (914mm)	1". (25)
3' 0". (914mm) to less than 4' 0". (120 mm)	3". (76)
4' 0". (120 mm) to less than 4' 6". (140 mm)	5". (127)
4' 6". (1.4m) to less than 6' 0". (180 mm)	7". (178)
6' 0". (180 mm) to less than 6' 6". (200 mm)	9". (229)
6' 6". (200 mm) to less than 7' 0". (210 mm)	11". (279)
7' 0". (210 mm) to less than 8' 0". (240 mm)	14". (356)
8' 0". (240 mm) to less than 8' 6". (260 mm)	15". (381)
8' 6". (260 mm) to less than 9' 0". (270 mm)	17". (429)

FIGURE 25A: OBSTRUCTIONS AT UPPER DECK FL-SA/RE SPRINKLER



DISTANCE FROM SPRINKLER TO SIDE OF OBSTRUCTION C feet (m)	MAXIMUM ALLOWABLE DISTANCE OF DEFLECTOR ABOVE BOTTOM OF OBSTRUCTION A inches (mm)
Less than 8' (2.4)	NOT ALLOWED
8' (2.4) to less than 10' (3)	1" (25)
10' (3.0) to less than11' (3.3)	2" (51)
11' (3.3) to less than 12' (3.7)	3" (76)
12' (3.7) to less than 13' (4)	4" (102)
13' (4) to less than 14' (4.3)	6" (152)
14' (4.3) to less than 15' (4.6)	7" (178)
15' (4.6) to less than 16' (4.9)	9" (229)
16' (4.9) to less than 17' (5.2)	11" (279)
17' (5.2) or greater	14" (356)

FIGURE 25B: OBSTRUCTIONS AT UPPER DECK FL-SA/DS SPRINKLER

FIGURE 25: OBSTRUCTIONS AT UPPER DECK

5.0 PERFORMANCE (CONTINUED)

Obstructions

Piggyback Trusses

When trusses are stacked ("Piggyback") at the peak, consideration to obstructions to the spray pattern of the RE sprinklers must be made. These "Piggyback" configurations will typically include 2X "Stiffeners" running perpendicular to the trusses. Additionally, these "stiffeners" will be sandwiched between the uppermost and lowermost horizontal chords of the two stacked trusses. In the event that all members are above the level of the FL-SA/RE deflector, no obstruction exists to the FL-SA/RE spray pattern. See FIGURE 26 and FIGURE 27.

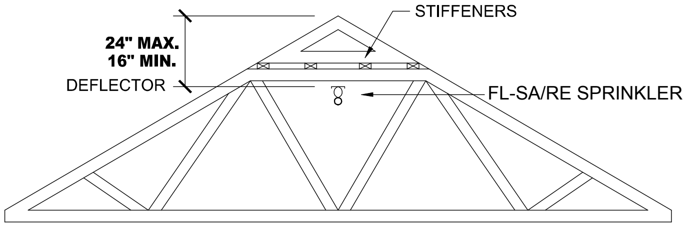


FIGURE 26: DEFLECTOR COMPLETELY BELOW STIFFENERS AND HORIZONTAL WEB MEMBERS (NO OBSTRUCTION)

In the event that the FL-SA/RE Deflector is located completely above the stiffeners and horizontal web members, the parameters of FIGURE 27 must be met for the spray pattern to be considered unobstructed.

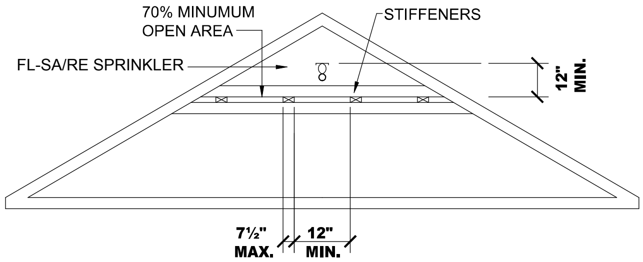


FIGURE 27: DEFLECTOR ABOVE STIFFENERS AND HORIZONTAL WEB MEMBERS (NO OBSTRUCTION)

5.0 PERFORMANCE (CONTINUED)

CPVC Guidelines

Use Of UL Listed CPVC Piping With Globe Specific Application Attic Sprinklers (Wet Systems Only)

UL Listed CPVC piping may be used in a combustible concealed attic space requiring sprinklers when installed in accordance with the following guidelines. For clarity, the following guidlines reference both "Ridgeline/ Downslope" areas as well as "Hip" areas.

Notice: For installations in accordance with FIGURE 28, where the use of non-combustible insulation is specified, verify with the insulation manufacturer as to the non-combustibility of the insulation. The non-combustible insulation (fiberglass) may be faced or unfaced. Where faced, the facing need not be non-combustible. The insulation is to have a flame spread index of not more than 25. Verify chemical compatibility of the insulation with the UL Listed CPVC by consulting the CPVC Manufacturer's literature.

CPVC At Bottom Chords To Feed Ceiling Sprinklers Below

UL Listed CPVC may be used to feed the wet system ceiling sprinklers on the floor below when adhering to the following guidelines: (See FIGURE 28)

- There must be 6 in. (152.4 mm) of non-combustible insulation covering the horizontal or vertical pipe extending 12". (304.8 mm) on each side away from the centerline of the pipe. Refer to FIGURE 28A.
- The area above the pipe must be protected with FL-SA/RE and FL-SA/DS Special Application Attic Sprinklers. If the pipe is located inside the ceiling joist, the joist channel must be covered or filled with 6". (152.4 mm) of non-combustible insulation on top of the pipe and the area above must be protected by FL-SA/RE and/or FL-SA/DS Sprinklers. Refer to FIGURE 28B. Insulation is for fire protection purposes. It is not freeze protection. CPVC must be installed in accordance with the CPVC Manufacturer's installation guide instructions.

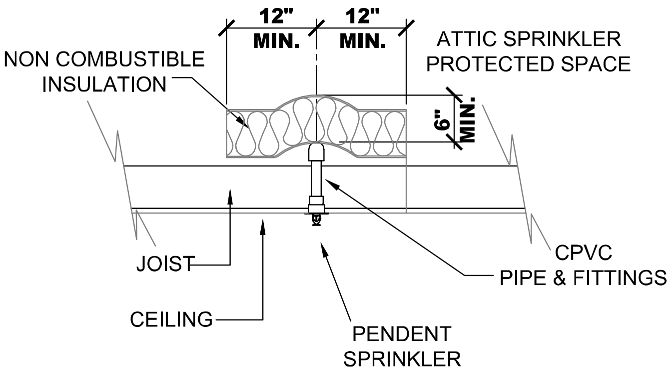


FIGURE 28A

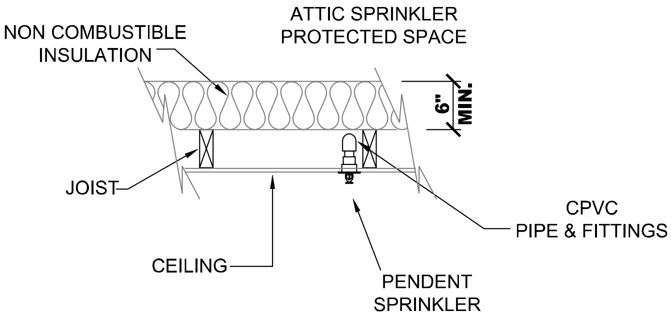


FIGURE 28B

FIGURE 28: NON-COMBUSTIBLE INSULATION FOR THE PROTECTION OF CPVC PIPE

5.0 PERFORMANCE (CONTINUED)

CPVC Guidelines

Use of UL Listed CPVC Piping with Specific Application Attic Sprinklers (Wet Systems Only)

Exposed CPVC at Ridgeline/Downslope Areas Only

UL Listed CPVC Pipe and Fittings may be used to feed the FL-SA/RE and FL-SA/DS sprinklers protecting the attic space when adhering to the following guidelines: (See FIGURE 29)

- Wet Systems only
- Risers are vertical and protected by FL-SA/RE or FL-SA/DS Sprinklers located at a maximum lateral distance of 12". (304.8 mm) from the riser centerline.
- FL-SA/RE or FL-SA/DS Sprinklers are directly mounted on the branchline.
- FL-SA/RE or FL-SA/DS Sprinklers are on arm-overs and located at a maximum lateral distance of 6". (152.4 mm) from the branchline centerline.
- FL-SA/RE or FL-SA/DS Sprinklers are on vertical sprigs attached to the branchline.

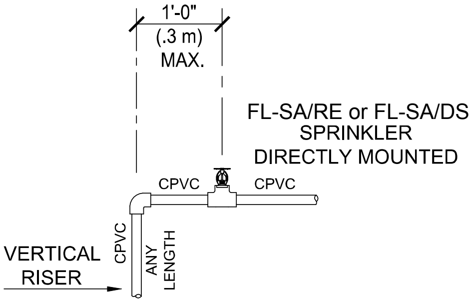


FIGURE 29A
VERTICAL RISER DIRECT MOUNT

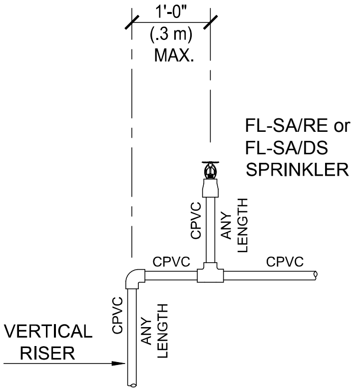


FIGURE 29B
VERTICAL RISER SPRIG UP

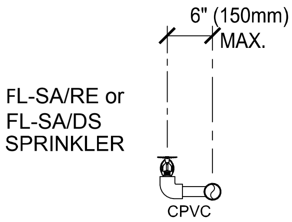


FIGURE 29C
DIRECT MOUNT
ARM-OVER

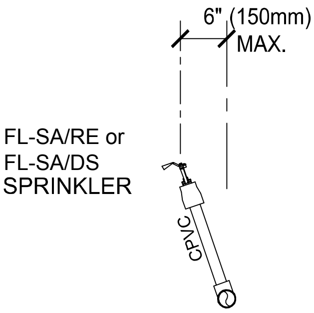


FIGURE 29D
ANGLED SPRIG

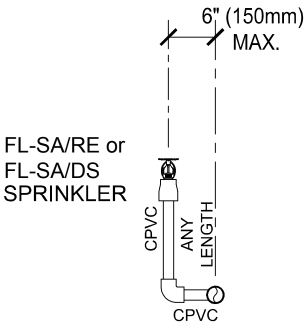


FIGURE 29E
ARM OVER SPRIG

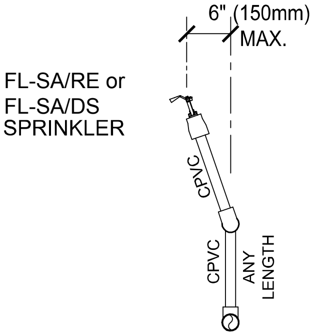


FIGURE 29F
VERTICAL SPRIG WITH
SWING JOINT

FIGURE 29: CPVC ALLOWANCE GUIDELINES
WET SYSTEMS ONLY
(DIRECTLY FEEDING FL-SA/RE / FL-SA/DS SPRINKLERS)

5.0 PERFORMANCE (CONTINUED)

CPVC Guidelines

CPVC at Hip Areas

Listed CPVC may be used to feed the FL-SA/RE and FL-SA/DS sprinklers protecting the Hip areas when adhering to the following guidelines:

- Wet systems only
- When the horizontal branchline piping feeding sprinklers within the hip roof areas is run over the bottom chords of the trusses, it shall be covered with a minimum of 6". (152.4 mm) in depth of non-combustible insulation (See FIGURE 31). This insulation must extend nominally 12". (304.8 mm) on each side away from the centerline of the CPVC branchline. Insulation is for fire protection purposes. It is not freeze protection.
- When the horizontal CPVC branchline piping feeding the sprinklers within the hip roof areas is located within the ceiling joist, the joist channel must be covered or filled with a minimum of 6" (152.4 mm) depth of noncombustible insulation on top of the branchline feeding the sprigs (See FIGURE 30). Insulation is for fire protection purposes. It is not freeze protection.
- A minimum lateral distance of 18" (450 mm) is maintained between the CPVC pipe and a heat producing device such as heat pumps, fan motors, and heat lamps.
- The sprinklers (RE or DS) may be fed by exposed vertical sprigs directly to a sprinkler or exposed angled sprigs directly to a sprinkler provided:
    - Vertical sprigs have no maximum exposed length, the RE or DS Sprinkler is located at a maximum lateral distance of 12" (3304.8 mm) from the sprig centerline.
    - Angled sprigs with a maximum exposed length of 3' (0.9 m).

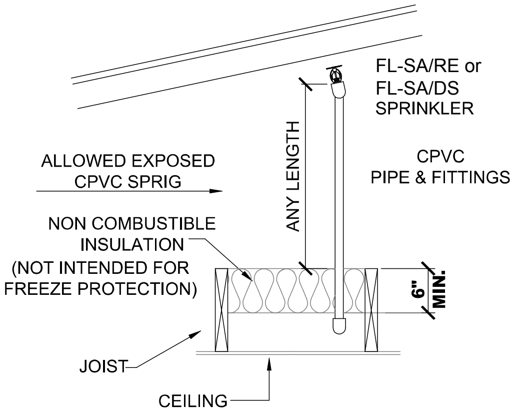


FIGURE 30A
VERTICAL SPRIG

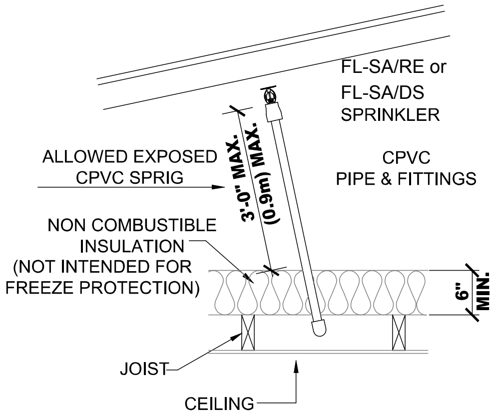


FIGURE 30B
ANGLED SPRIG

FIGURE 30: EXPOSED CPVC AT HIP ROOF AREAS
(HORIZONTAL BRANCHLINE WITHIN JOISTS)
WET SYSTEMS ONLY

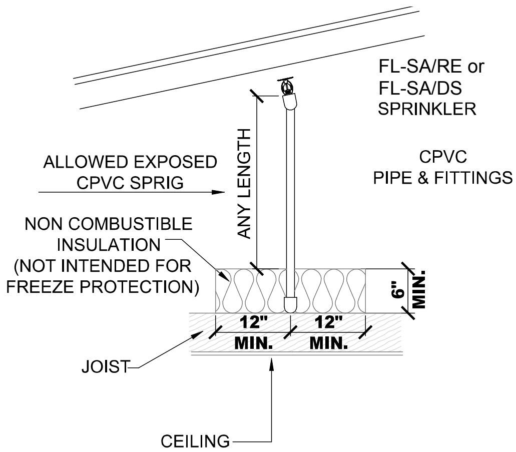


FIGURE 31A
VERTICAL SPRIG

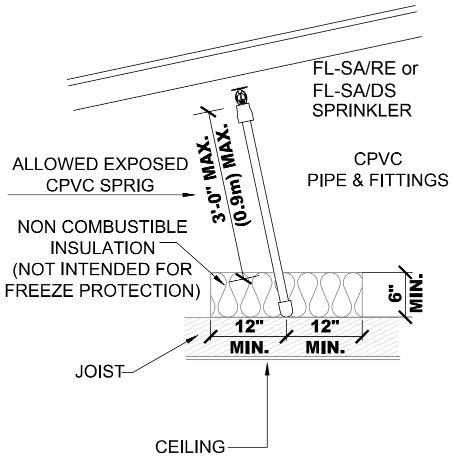


FIGURE 31B
ANGLED SPRIG

FIGURE 31: CPVC AT HIP ROOF AREAS
(HORIZONTAL BRANCHLINE OVER JOISTS)
WET SYSTEMS ONLY

5.0 PERFORMANCE (CONTINUED)

Slope to Flat Transition

When transitioning from a flat-to-slope roof, a draft curtain shall be installed as shown, and the area under the flat roof shall be hydraulically calculated in accordance with the requirements of NFPA 13.

NOTE

- The use of CPVC piping under the flat roof section would only be allowed if Specially Listed sprinklers are being used which allow for such use of CPVC. All specially Listed guidelines must be met.

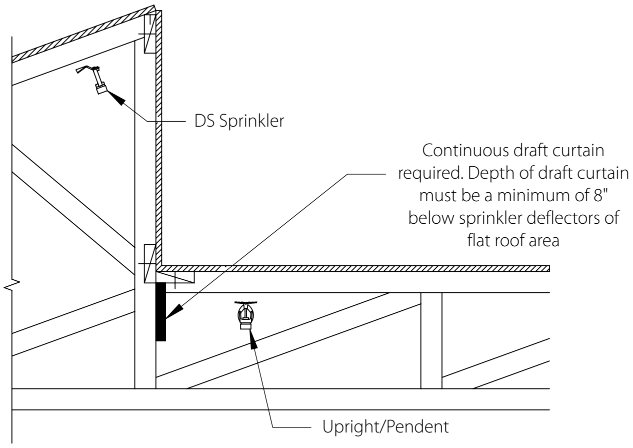


FIGURE 32A: SINGLE SLOPE TRANSITION WITH FLAT ROOF BELOW PEAK

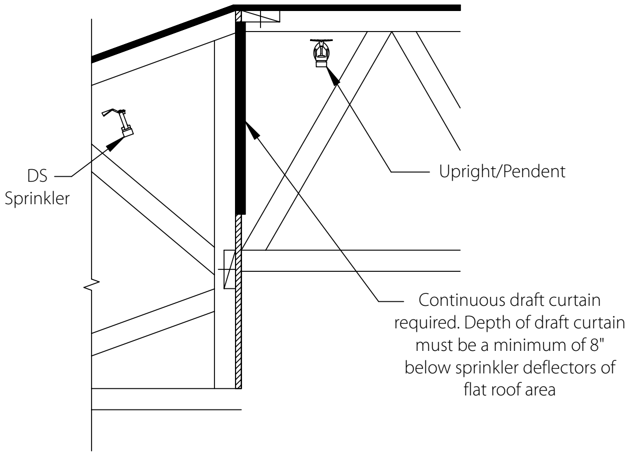
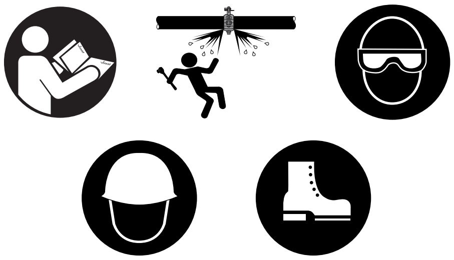


FIGURE 32B: SINGLE SLOPE TRANSITION WITH FLAT ROOF AT OR ABOVE PEAK

FIGURE 32: SLOPE TO FLAT TRANSITION

6.0 NOTIFICATIONS

WARNING



- **Read and understand all instructions before attempting to install any Victaulic products.**
- **Always verify that the piping system has been completely depressurized and drained immediately prior to installation, removal, adjustment, or maintenance of any Victaulic products.**
- **Wear safety glasses, hardhat, and foot protection.**

Failure to follow these instructions could result in death or serious personal injury and property damage.

- **These products shall be used only in fire protection systems that are designed and installed in accordance with current, applicable National Fire Protection Association (NFPA 13, 13D, 13R, etc.) standards, or equivalent standards, and in accordance with applicable building and fire codes. These standards and codes contain important information regarding protection of systems from freezing temperatures, corrosion, mechanical damage, etc.**
- **The installer shall understand the use of this product and why it was specified for the particular application.**
- **The installer shall understand common industry safety standards and potential consequences of improper product installation.**
- **It is the system designer's responsibility to verify suitability of materials for use with the intended fluid media within the piping system and external environment.**
- **The material specifier shall evaluate the effect of chemical composition, pH level, operating temperature, chloride level, oxygen level, and flow rate on materials to confirm system life will be acceptable for the intended service.**

Failure to follow installation requirements and local and national codes and standards could compromise system integrity or cause system failure, resulting in death or serious personal injury and property damage.

7.0 REFERENCE MATERIALS

Ratings: All glass bulbs are rated for temperatures from -67°F/-55°C.

I-40: Victaulic FireLock™ Automatic Sprinklers

SECTION 7

Miscellaneous

PTFE THREAD SEAL TAPE
(INDUSTRIAL)

Meets MIL Spec T-27730A

- •For all industrial applications.
- •Made from 100% virgin PTFE.
- •No pigments, no additives.
- •Exceeds MILSpec T-27730A.
- •Temperature range of -450F to +550F.
- •VOC’s (Volatile Organic Compounds): Minimal. 1.5% or less
- •May be used on all applicationsincluding water, oil, chemical, medical, and food processing where non-contamination standards are high.

60-10-260	1/2” x 260” STANDARD 0.4 DENSITY INDUSTRIAL GRADE
60-10-262	1/2” x 520” STANDARD 0.4 DENSITY INDUSTRIAL GRADE
60-10-264	1/2” x 1296” STANDARD 0.4 DENSITY INDUSTRIAL GRADE
60-10-262	3/4” x 260” STANDARD 0.4 DENSITY INDUSTRIAL GRADE
60-10-267	3/4” x 520” STANDARD 0.4 DENSITY INDUSTRIAL GRADE
60-10-269	3/4” x 1296” STANDARD 0.4 DENSITY INDUSTRIAL GRADE
60-10-270	1” x 260” STANDARD 0.4 DENSITY INDUSTRIAL GRADE
60-10-271	1” x 520” STANDARD 0.4 DENSITY INDUSTRIAL GRADE
60-10-272	1” x 1296” STANDARD 0.4 DENSITY INDUSTRIAL GRADE

System No.		Location	
Submitted By		Date	

Spec Section		Paragraph	
Approved		Date	

TUF-GLIDE
Thread Sealant with PTFE

Tuf-Glide® is the #1 selling PTFE paste in the fire sprinkler industry.
It has replaced it's competitors as the pipefitters choice.

APPLICATIONS:
Tuf-Glide may be used on steel, aluminum, brass, copper, iron, reinforced fiberglass, CPVC, PVC and ABS threaded connections. Not for use with Stainless Steel Pipe.

Tuf-Glide thread sealant is a non hardening, safe to use sealant containing PTFE for sealing and protecting threaded connections. Its low coefficient of friction allows tight makeup with low torque and breaks out easily without damaging threads.

Tuf-Glide contains no lead or other harmful metals and is perfectly safe for use on potable water lines.
Contains no silicone.
NOT FOR USE ON OXYGEN LINES.

Tuf-Glide is recommended for threaded pipe carrying:

Acids, Dilute	Helium Gases
Air	Hydraulic OIl
Ammonia	Inert Gases
Aliphatic Solvents	Kerosene
Brine	LP Gases
CO2	Mineral Oils
Caustic, Dilute	Natural Gas
Cold Tar Naphtha	Nitrogen, Gaseous
Cutting Oils	Petroleum Solvents
Fatty Acids	Steam
Heating Oils	Vegetable Oils
Freon	Water

Tuf-Glide is listed under the Uniform Plumbing Code (IAPMO), File No. 1282.
Conforms to Federal Specification TT-S-1732 and the require-ments
of British Standard 6920: Parts 1 & 2.
TFW is recommended for Plumbing, HVAC, Industrial Piping, Chemical Processing Plants, Manufacturing Plants, Gas Utilities and Fire Sprinkler Piping. Meets U.S. Federal Specification TT-S-1732.

VOC Content: Zero Grams per Liter

ITEM #	DESCRIPTION
1010005	1/2 PINT with BRUSHTOP
1010006	1 PINT with BRUSHTOP
1010007	1 QUART FLAT TOP
1010008	1 QUART with BRUSHTOP
1010009	1 GALLON PAIL
1010010	5 GALLON PAIL
1010011	55 GALLON DRUM

FBC™ System Compatible indicates that this product has been tested, and is monitored on an ongoing basis, to assure its chemical compatibility with FlowGuard Gold®, BlazeMaster® and Corzan® piping systems and products made with TempRite® Technology."
"The FBC System Compatible Logo, FBC™, FlowGuard Gold®, BlazeMaster®, Corzan®, and TempRite® are trademarks of Lubrizol Advanced Materials, Inc. or its affiliates.

Service Rating: -35° F (-37° C) to 500° F (260° C)
Pressures: to 10,000 psi for liquids, 2,000 psi for gases
Shelf Life: Indefinite
V.O.C. Content: None
Fluid Type: Synthetic
Color/Appearance: White Grainy Paste
Dropping Point: (ASTM D-566) Not Applicable
Specific Gravity: 1.20
Density (lb/gal): 10.0
Oil Separation: <5.0
WT. % LOSS @ 212°F (100°C)
Flash Point: (ASTM D-92) >350°F (177°C)
Nonvolatile Content: 100%
Viscosity, Brookfield (ASTM D-2196)
#7 Spindle, 5 rpm @ 77°F (25°C) 160,000-260,000 cps
Brushable To: 0°F (-18°C)
Copper Strip Corrosion: 1A
(ASTM D-4048)

System No.		Location		Spec Section		Paragraph	
Submitted By		Date		Approved		Date	

TUF-GLIDE
Thread Sealant with PTFE

California Proposition 65 requirements are that any material produced after October 31st be labeled with the statement below. The only product considered hazardous in ARGCO TUF-GLIDE is Titanium dioxide which is still food grade allowable. Additionally titanium dioxide is only a respirable cancer substance when in a submicron size. Since it is encapsulated in a paste and greater than 1 micron particle size for the largest percentage it is debatable it even needs to be reported as there is no exposure mode.

WARNING: This product can expose you to Titanium dioxide, which is known to the State of California to cause cancer.
For more information go to www.P65Warnings.ca.gov.

Below is the formula chemical list for ARGCO TUFGLIDE with CAS Numbers.

INGREDIENT	CAS #
Polybutenes	9003-29-6
Calcium sulfonate	61789-86-4
Potassium aluminum silicate	12001-26-2
Kaolin Clay	1332-58-7
Polyethylene	9002-88-4
Talc	14807-96-6
PTFE	9002-84-0
Titanium dioxide (1.2%)	13463-67-7
Organophyllic clay	68953-58-2

System No.		Location		Spec Section		Paragraph	
Submitted By		Date		Approved		Date	

ASC Engineered Solutions

ThreadFit® CLEAR Thread Cutting Oil
Fig. 03-16A

Description

ThreadFit® CLEAR Thread Cutting Oil for Sprinkler Pipe is an excellent heavy duty, light colored cutting oil for all types of ferrous metal. It's special combination of anti-wear and anti-weld additives provides all the necessary lubricity and cooling modern pipe threading operations require. This balanced combination of additives will help improve die life and thread quality over other cutting oils and is Chlorine free. ThreadFit Clear's low smoke/ low odor formulation makes it ideal for use in high speed threading applications.

Features

- Heavy Duty Cutting Oil
- Excellent Tool Life
- Chlorine Free
- All types of ferrous metal or pipe
- Improved Surface Finish
- Low Odor
- Low Smoke

Installation

ThreadFit® can be used in automatic and hand held applicators. Fill oil reservoir according to equipment manufacturers specifications. Mixing of different types of threading oils is not recommended. DO NOT ALTER THE CONSISTENCY OF THIS PRODUCT. Use as is directly from the container. Change oil regularly for optimum performance. Contains petroleum oil. Avoid breathing mists or vapors. Avoid eye contact and prolonged or repeated contact with skin. Wear safety glasses or goggles. Use good personal hygeine. Dispose of used oil in accordance with all local, State and Federal ordinances and regulations. Consult Material Safety Data Sheets for additional safety and handling information. DO NOT MIX WITH OTHER THREAD CUTTING OILS OR CONTAMINANTS.

Specifications

Appearance:
Clear amber liquid.
Packaging:
1 gl. (6/case)
5 gl. Pail
55-gl drum
275-gl tote

Caution:
Skin contact: wash thoroughly with soap and water. Eye contact: flush eyes with water for at least 15 minutes and seek medical attention. Ingestion: consult a physician immediately. Inhalation: move affected person(s) to fresh air and seek medical attention. See SDS for first aid instructions.

Spill or Leak:
Soak up with an oil absorbent compound. Follow all state, local, Federal regulations for disposal. Don't pollute. Conserve our resources-Please recycle this container.

See Safety Data Sheet for additional safety and disposal information at www.fppi.com

This product is registered with CHEMTREC, a 24-hour emergency hotline. They may be reached at 1 800 424-9300.

FBC SYSTEM COMPATIBLE

FBC™ System Compatible indicates that this product has been tested, and is monitored on an ongoing basis, to assure its chemical compatibility with FlowGuard Gold®, BlazeMaster® and Corzan® pipe fittings. FBC™, FlowGuard Gold®, BlazeMaster® and Corzan® are licensed trademarks of The Lubrizol Corporation or its affiliates.

SPEARS COMPATIBLE

Spears® Compatible indicates that ThreadFit® CLEAR Thread Cutting Oil has been tested by Spears® Manufacturing to be compatible with Flameguard® pipe and futtings.

FPPI
An ASC Engineered Solution

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ Approved
Address:	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	Remarks:
Submittal Date:	
Notes 1:	
Notes 2:	

LubeFit® Gasket Lubricant

INSIST ON FPPI®

Description

LubeFit® is a vegetable fiber based lubricant for all gasketed fittings, including grooved couplings for fire sprinkler systems and all grades of EDPM gaskets. It is non staining* and does not support bacterial growth. LubeFit® can be easily applied in temperatures from -10°F to 150°F. LubeFit® is non-toxic and water soluble. Under normal conditions, LubeFit® is not harmful to the skin.

Design Criteria/Data

- Water dispersible
- Applies equally well to wet or dry surfaces
- Suitable for all types of pipe lines, including potable water
- Excellent working range -10° to 150°
- Will not support bacteria
- Will not deteriorate natural or Synthetic rubber, plastic gaskets or caston iron pipe
- Certified to NSF/ANS/Std 61-G

FBC™ SYSTEM COMPATIBLE

FBC™ System Compatible indicates that this product has been tested, and is monitored on an ongoing basis, to assure its chemical compatibility with FlowGuard Gold®, BlazeMaster® and Corzan® pipe and fittings. FBC™, FlowGuard Gold®, BlazeMaster® and Corzan® are licensed trademarks of The Lubrizol Corporation or its affiliates.

SMITH COOPER
COMMERCE, CA 90040
+ 1 (800) 766-0076
+ 1 (323) 890-4456 FAX

Application

LubeFit® should be applied in an even and thin amount over the parts to be lubricated. Avoid applying excessive amounts. The best applicaion is achieved when applying by hand. Clean all dirt, burrs and foreign matter from the joint surfaces. Make certain the gasket is properly located. Apply an even coating of lubricant to all fitting surfaces and gasket. Assemble the joint according to the pipe fitting manufacturer's directions.

Disclaimer

DO NOT ALTER THE CONSISTENCY OF THIS PRODUCT. Use as is directly from the container. Keep away from your mouth and eyes. If eye contact occurs, flush with water for 5 minutes. If discomfort persists get medical attention. *Will stain untreated porous surfaces such as concrete if not cleaned from the surface immediately.

The information contained herein is produced in good faith and is believed to be reliable but is provided for guidance and information purposes only. FPPI and its agents cannot assume liability or responsibility for results obtained in the use or misuse of its product by persons whose methods and qualifications are outside and beyond our control. It is the user's responsibility to determine the suitability of, methods of use, preparation prior to use, and appropriate installation for all products purchased from FPPI. It is the user's sole responsibility to observe and adapt such precautions as may be advisable or necessary for the protection of personnel and property in the handling and use of any of our products.

Specifications

Appearance:
Dense, paste like consistency and is light brown or tan in color.

Contains:
Potassium Oleate, Propylene Glycol and Mica. Contains NO PETROLEUM. LubeFit® is not manufactured with silicone in its formula.

Packaging:
2lb (1-quart approx.)
55-gl drum
(400 lbs. approx.)

See Safety Data Sheet for additional safety and disposal information at www.fppi.com

CAUTION: Eye irritant. Avoid contact with eyes. Wash thoroughly after use.

MADE IN U.S.A.

NSF

SPEARS® MANUFACTURING COMPANY

FS-5 RED

TECHNICAL SPECIFICATIONS

Low VOC CPVC Solvent Cement

PRODUCT:

Spears® FlameGuard® FS-5 RED One-Step (no primer required) CPVC cement specifically formulated and approved for use with Spears® FlameGuard® and other approved CPVC Fire Sprinkler Products with interference fit through 3".

INTENDED USE:

Spears® FS-5 is approved for use with Spears® FlameGuard® and other approved CPVC Fire Sprinkler Products. See publication FG-3, FlameGuard® Installation Instructions for additional application details.

GENERAL PRODUCT SPECIFICATIONS:

COLOR:	Red
RESIN:	CPVC
SPECIFIC GRAVITY:	0.985 ± 0.04
BROOKFIELD VISCOSITY	Heavy Body - Minimum 1600 cP@ 73 ± 2°F (23°C +1° C)
RELATIVE SET:	Fast
MAX VOC EMISSIONS:	490 g/L per SCAQMD Rule 1168/316A
SHELF LIFE:	2 years from date stamped on the bottom of container.

Note: Product usability is limited by the evaporation of the solvents when the container is opened and can cause the cement to thicken and reduce its usefulness. Always seal the can tightly between uses to prevent the solvent from becoming thickened, stringy or jelled. Do not add thinners to change viscosity of thickened cement. Significant changes in cement properties can result.

CONFORMANCE STANDARDS AND APPROVALS:

- NSF®/ANSI Standard 14 Listed and Certified for compliance to ASTM F493
- NSF®/ANSI Standards 14/61 Listed and Certified for Potable Water, Drain Waste and Vent, and Sewer service use (NSF®-PW, DWV, SW) NSF® Listed and Certified to requirements of the Uniform Plumbing Code (NSF® U.P. Code); NSF® Certified Lead-Free.
- FM® and UL® approved for use with Spears® FlameGuard® and other approved CPVC Fire Sprinkler Products.
- Meets SCAQMD Rule 1168/316A for Compliance with LEED® (Leadership in Energy and Environmental Design). Low VOC product credit can be claimed for LEED Green Building Rating System - Indoor Environmental Quality.

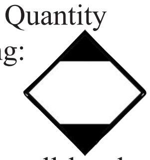
PACKAGING, SHIPPING & TRANSPORTATION INFORMATION:

Can Size	Standard Case Quantity
Pint	12
Quart	12

The following is general information for ground shipping, see SDS FS5-6 for additional detail.

Proper Shipping Name: Adhesive
Hazard Class: 3
Identification Number: UN 1133
Packing Group: II
Label Required: Class 3 Flammable Liquid

Exceptions for Quantities < 1 liter
Classification: Limited Quantity
49CFR172.315 Marking:



Note: Purchasers who may repackage this product must also conform to all local, state and federal labeling, safety and other regulations.

SAFETY & USE PRECAUTIONS:

WARNING: CAN CAUSE SERIOUS EYE IRRITATION. HARMFUL IF INHALED. MAY CAUSE DROWSINESS OR DIZZINESS. MAY CAUSE RESPIRATORY IRRITATION. REPEATED EXPOSURE MAY CAUSE SKIN DRYNESS OR CRACKING. KEEP OUT OF REACH OF CHILDREN.

Do not take internally. Keep away from heat, spark, open flame, other sources of ignition. Vapors may ignite explosively. Use only in well ventilated area; if not well ventilated, use forced ventilation or NIOSH approved respirator. Avoid breathing vapors. Do not smoke, eat or drink while using. Avoid contact with skin and eyes. Use skin and eye protection. Eye contact may cause injury. Keep container closed when not in use. Contains Tetrahydrofuran (CAS#109-99-9); Methyl Ethyl Ketone (CAS# 78-93-3); Cyclohexanone (CAS# 108-94-1); Acetone (CAS# 67-64-1); CPVC Resin (CAS# 68648-82-8).

FIRST AID

Contact with eyes: Flush eyes immediately with plenty of water for 15 minutes and seek medical advice immediately.

Skin contact: Remove contaminated clothing and shoes. Wash skin thoroughly with soap and water. If irritation develops, seek medical advice.

Inhalation: Remove to fresh air. If breathing is stopped, give artificial respiration. If breathing is difficult, give oxygen. Seek medical advice.

Ingestion: Rinse mouth with water. Give 1 or 2 glasses of water or milk to dilute. Do not induce vomiting. Seek medical advice immediately.

INSTALLATION & INSTALLER TRAINING

FS-5 is specialty cement; see Spears® publication FG-3, FlameGuard® Installation Instructions, for specific details and limitations. Installation instructions are printed on the can label and instructional information is available on Spears® website at www.spearsmfg.com. Certified Installers Training for FlameGuard® CPVC Fire Sprinkler Systems is also available. Contact Spears® for additional instructional information or formal training.

AVOID USE AROUND DRY GRANULATED CALCIUM HYPOCHLORITE

While CPVC Fire Sprinkler Systems typically are not disinfected, a fire or explosion may result if dry granular calcium hypochlorite is used to disinfect plastic piping systems that are exposed to organic vapors found in solvent cements, cleaners or primers when a water solution is not used. Calcium hypochlorite is a strong oxidizer and common in Pool & Spa chemicals such as "pool-shock". If required, it is recommended to purify lines by pumping nonvolatile chlorinated water into the piping system. Do not store or use dry granular calcium hypochlorite near solvent cements, cleaners and primers.

Refer to Safety Data Sheet (SDS), Spears® publication FS5-6, for more information.

LIMITED LIFETIME WARRANTY:

Spears® Manufacturing Company warrants all new Solvent Cement and Primer products shall be free from defects in material and workmanship for the specified product shelf life based on the assigned manufactured date on the original product container. If any such product becomes defective under normal use and storage conditions during this warranty period, Spears® will replace the nonconforming solvent cement or primer product without charge. Spears® liability will be limited, without exception, to product replacement. Spears® further warrants properly made solvent cement joints using this product for the life of the system. See Spears® standard Limited Lifetime Warranty for additional detailed information and exclusions.

Progressive Products From Spears® Innovation & Technology

SPEARS® MANUFACTURING COMPANY
15853 Olden St, Sylmar, CA 91342 • PO Box 9203, Sylmar, CA 91392
(818) 364-1611 • www.spearsmfg.com

HIGH-PERFORMANCE INTUMESCENT FIRESTOP SEALANT FS-ONE MAX

Product description

- Intumescent (expands when exposed to fire) firestop sealant that helps protect combustible and non-combustible penetrations for up to 4 hours fire rating

Applications for use

- For effectively sealing most common through penetrations in a variety of base materials
- For use on concrete, masonry and drywall
- Mixed and multiple penetrations
- Metal pipe penetrations: copper, steel and EMT
- Insulated metal pipe penetrations: steel and copper
- Plastic pipe penetrations: closed or vented

Advantages

- One product for a variety of common through penetrations
- Cost-effective, easy-to-use solution
- Water-based and paintable
- Industry-leading VOC results
- Ethylene glycol-free

Installation instructions

- See Hilti literature or third-party listings for complete application and installation details

Technical Data*

Chemical basis	Water-based acrylic dispersion
Approx. Density	84.3 lb/ft³
Color	Red
Approx. cure time1)	2mm / 3 days
Application temperature range2)	35°F to 104° (1.5C to 40°C)
Temperature resistance range	-4°F to 212°F (-20°C to 100°C)
Storage Temperature	35°F to 77F (1.5°C to 25°C)
Tack free time	20mins (@ 73°F / 50% rel. humidity)
Shelf life	18 months
Temperature resistance range	-4°F to 212°F
Mold and mildew performance	Class 0 (ASTM G21-13)
Mold and mildew resistant	Yes
Expansion ratio (unrestricted, up to)	1:5
Paintable	Yes
Chemical resistance	Yes
Electrical resistance	Yes
FBC compatible (Lubrizol)	Yes
Intumescent	Yes
W-rating	Yes
M-rated	Yes
LEED VOC (input)	9 g/L
LEED V4 Compliant	Yes (CDPH v1.2-2017)
STC rating (ASTM E90)	62 (relates to specific construction)
Movement	±7.5%
Surface burning characteristics (ASTM E 84-14)	Flame Spread: 0 Smoke Development: 10
California State Fire Marshal approval	CSFM Listing 4485-1200:0108 for FS-ONE MAX Intumescent Firestop Sealant
Tested in accordance with	ASTM G21, ASTM E 90, CAN/ULC-S115, UL 1479, ASTM E 814 , ASTM E84

Order Information

Designation	Qty per package	Item number
FS-ONE MAX 10oz tube (1 case)	12x Firestop sealant FS-ONE MAX 10 oz cartridge	3530249
FS-ONE MAX 20oz foil (1 case)	25x Firestop sealant FS-ONE MAX 20 oz foil	3530250
FS-ONE MAX 10 oz cartridge	1x Firestop sealant FS-ONE MAX 10 oz cartridge	2101531
FS-ONE MAX 5 gallon pail	1x Firestop sealant FS-ONE MAX 5 gallon pail	2101533

CLASSIFIED c UL US
FILL, VOID OR CAVITY MATERIAL
FOR USE IN THROUGH-PENETRATION
FIRESTOP SYSTEMS
SEE UL FIRE RESISTANCE DIRECTORY
66Y7

US
Intertek

FM APPROVED

FBC SYSTEM COMPATIBLE
Visit fbcsystemcompatible.com.
FBC™ is a trademark of the Lubrizol Corporation.

Chemical resistant

Mold and mildew resistant

W rated SYSTEMS AVAILABLE

Volume per unit:
- Caulk tube = 10.5 fl. oz (18.9in³)
- Foil = 600ml (36.4in³)
- Pail = 5gal (1,155in³)

1) At 75°F (24°C) and 50% relative humidity

2) For ambient and surface temperatures between 10°F (-12°C) and 35°F (1.5°C), the following conditions must apply:
- Substrate surfaces are clean and dry (e.g. free of dust, rust, grease, oil, dew, frost, ice, moisture, etc);
- Product maintained above 50°F (10°C) for a minimum of 24 hours prior to application;
- Product will not cure at ambient temperatures below 32°F / 0°C

Hilti Firestop
Saving lives through innovation and education

CAST-IN FIRESTOP DEVICES (CP 680-P, CP 680-PX, AND CP 680-M)

For use in

- Dust and fiber free environments such as hospitals, computer centers and laboratories
- Concrete floor assemblies rated up to 4 hours

Product description

- A one-step cast-in firestop device for a variety of pipe materials and diameters
- Helps reduce labor costs and increase productivity
- Ready-to-use out of the package
- Internationally tested and approved by UL and FM
- Helps reduce the chance of project delays due to failed inspections

Product features

- Quicker and simpler installation
- SpeedLine Alignment system promotes faster layout
- QuickTurn System creates faster, simpler vertical connections
- Integrated moisture and smoke seal
- Innovative adapter for metal deck applications

Installation and applications

- Concrete floors from 2.5" (63 mm) thickness for either flat concrete or concrete over metal deck
  CP 680-M:
  - Insulated and non-insulated metal pipes
  - EMT and electrical conduits
  - Cable bundles
  - Multiple pipes
  CP 680-P:
  Addresses all applications for CP 680-M as well as the following:
  - Plastic pipes such as PVC, CPVC, ABS, ENT and FRPP
  - Fresh and waste water pipes
  CP 680-PX:
  Addresses all applications for CP 680-M as well as the following:
  - XFR pipes

Not suited for

- Areas with high condensation
- Outdoor areas
- Wall applications

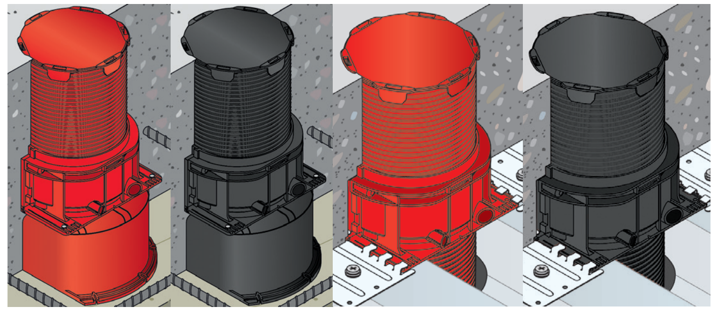
Installation and applications

Notice

- Before handling, read Material Safety Data Sheet and product label for safe usage and health information.
- Instructions below are general guidelines — always refer to the applicable drawing in the UL Fire Resistance Directory or Hilti Firestop Systems Guide for installation information

Instructions for use

- Before pouring concrete, secure the cover cap in place, thereby preventing the flow of concrete into the cast-in device
- Do not use for wall applications



CP 680-P and CP 680-PX in concrete over wood forms | CP 680-M in concrete over wood forms | CP 680-P and CP 680-PX over metal deck | CP 680-M over metal deck

Technical Data		**CP 680-P, CP 680-PX, and CP 680-M**
ID	**Footprint**	**Opening required thru metal deck**
2"	3-3/4" x 4-1/2"	3-1/2" diameter
3"	4-3/4" x 5-5/8"	4-1/2" diameter
4"	6-3/8" x 6-3/4"	5-1/2" diameter
6"	9" x 9-1/2"	7-1/2" diameter
Application temperature range		23°F to 122°F (-5°C to 50°C)
Expansion temperature		392°F (200°C)
Expansion rate		1:50 (unrestrained) 1:30 (Load expansion, Load = 20g/cm³)
Standard height		8"
Temperature resistance		Maximum 212°F (100°C)
Color		CP 680-P: red CP 680-M: black

Tested in accordance with
• UL 1479 • ASTM E 814 • ASTM G21 • CAN/ULC-S115

Internationally tested and approved

CLASSIFIED c UL us
FIRESTOP DEVICE
FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS
SEE UL FIRE RESISTANCE DIRECTORY
5N76

FM APPROVED

FBC SYSTEM COMPATIBLE

FBC™ System Compatible indicates that this product has been tested, and is monitored on an ongoing basis, to assure its chemical compatibility with FlowGuard Gold®, BlazeMaster® and Corzan® piping systems and products made with TempRite® Technology." "The FBC System Compatible Logo, FBC™, FlowGuard Gold®, BlazeMaster®, Corzan®, and TempRite® are trademarks of Lubrizol Advanced Materials, Inc. or its affiliates."

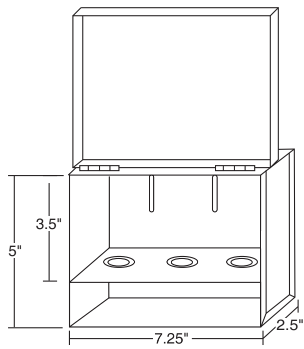
GKL • 03/23

FIRE SPRINKLER SPARE HEAD BOXES

- Heavy duty 20 gauge steel construction
- Red powder coated finish
- Knockouts and shelf to accommodate any 1/2” or 3/4” sprinkler head
- Shelf is positioned to allow for a typical sprinkler head wrench
- All-welded construction and full length hinge
- Slotted for easy mounting with screws, rivets or strapping

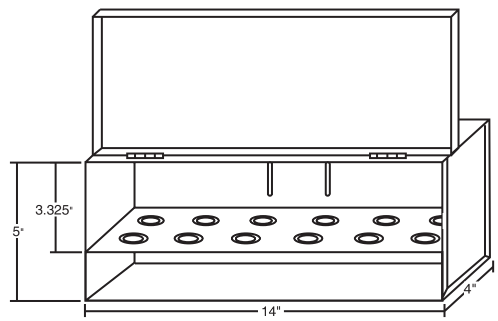
(Not intended for exposed or harsh environments)

3 Head Box



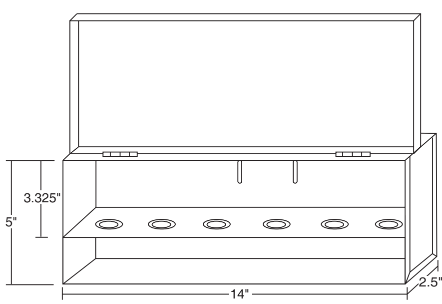
(6510152)

12 Head Box



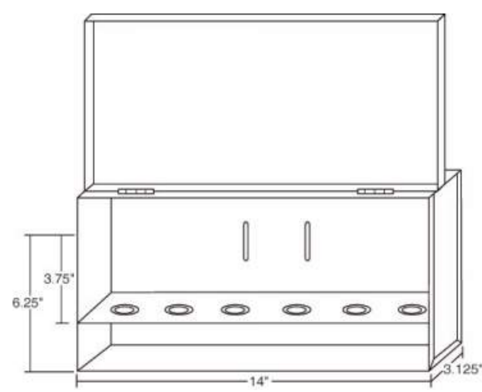
(6510150)

6 Head



(6510151)

6 Large Head Box



(6510151A)

System No.		Location		Spec Section		Paragraph	
Submitted By		Date		Approved		Date	

tyco®

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Two-Piece Recessed Escutcheons and Protective Paint Caps for Automatic Sprinkler Recessed Installation

IMPORTANT

Refer to Technical Data Sheet TFP2300 for warnings pertaining to regulatory and health information.

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Scan the QR code or enter the URL in a web browser to access the most up-to-date electronic version of this document. Data rates may apply.

docs.jci.com/tycofire/tfp770

General Description

The TYCO Style 10, 15, 20, 30, 40, 50, and 70 Recessed Escutcheons are designed for recessed installation with certain pendent and horizontal sidewall sprinklers. They are intended for use in areas with finished ceilings or walls, and the adjustment provided by these escutcheons reduces the accuracy to which fixed piping to the sprinklers must be cut, while providing a decorative recessed sprinkler installation.

Each two-piece escutcheon style provides for recessed sprinkler installations having total adjustments from the flush position as follows:

Style	Thread Size Inch NPT	Total Adjustment Inch (mm)
10	1/2	3/4 (19,1)
15	1/2	5/8 (15,9)
20	1/2	1/2 (12,7)
30	3/4	1/2 (12,7)
40	3/4	3/4 (19,1)
50	1/2	3/8 (9,5)
70*	3/8	3/4 (19,1)

* Use with Series TY-B and TY-FRB 10 mm orifice sprinklers only, refer to technical data sheet TFP670

The Style 10, 20, 30, 40, and 50 Recessed Escutcheons are redesignations for Central, Gem, and Star brands as follows:

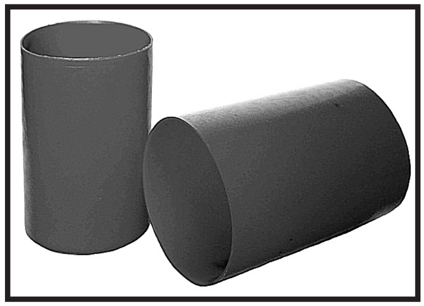
Style	Central	Gem	Star
10	3211	F700 (1/2 in.)	2085
20	3221	F705 (1/2 in.)	2084
30	4221	F705 (3/4 in.)	2086
40	4211	F700 (3/4 in.)	2088
50	307X	-	-

Note: *The Style 15 and 70 Recessed Escutcheons are not redesignated from any of the brands listed.*

Install Protective Paint Caps to help protect the sprinklers while finishing ceilings or walls as seen in Figures 8 and 9. Protective Paint Caps are ordered separately. The Model Z-392 is suitable for use with the Style 10, 15, 20, 30, 40, or 70 Recessed Escutcheons. The Model Z-84 is suitable for use with Style 50 Recessed Escutcheon only.

NOTICE

The Recessed Escutcheons described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the NATIONAL FIRE PROTECTION ASSOCIATION (NFPA), in addition to the standards of any authorities having jurisdiction, such as FM Global. Failure to do so may impair the performance of these devices.



The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

In all cases, the appropriate NFPA or FM Global installation standard, or other applicable standard, must be referenced to ensure applicability and to obtain complete installation guidelines. The general guidelines in this data sheet are not intended to provide complete installation criteria.

Technical Data

Approvals

Approval information, as applicable, for the Style 10, 15, 20, 30, 40, 50, and 70 Recessed Escutcheons is detailed in individual pendent and horizontal sidewall sprinkler data sheets that include details of recessed installation.

Materials and Finishes

Carbon steel chrome plated, white or black coated, or brass plated. Series 300 stainless steel white coated or plain unpolished. Other colors are available on special request.

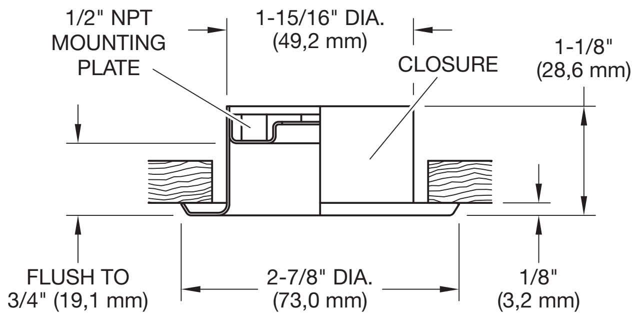


FIGURE 1
STYLE 10 RECESSED ESCUTCHEON,
1/2 IN. NPT - 3/4 IN. ADJUSTMENT

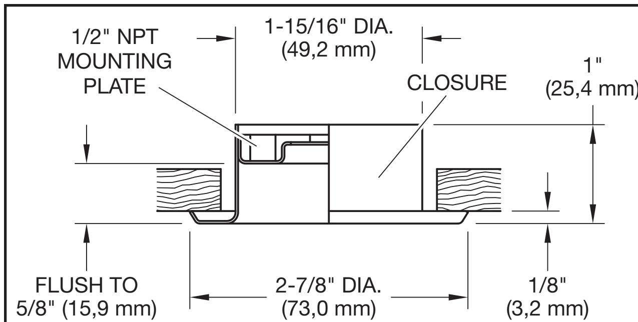


FIGURE 2
STYLE 15 RECESSED ESCUTCHEON
1/2 IN. NPT - 5/8 IN. ADJUSTMENT

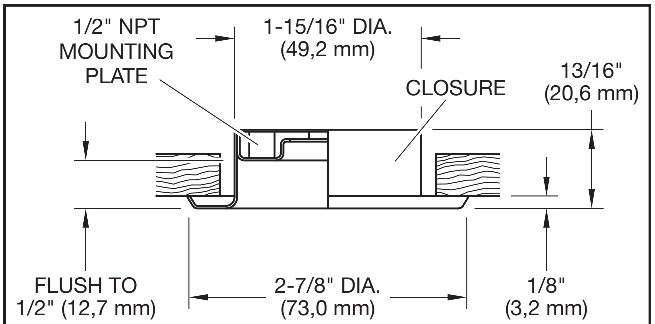


FIGURE 3
STYLE 20 RECESSED ESCUTCHEON
1/2 IN. NPT - 1/2 IN. ADJUSTMENT

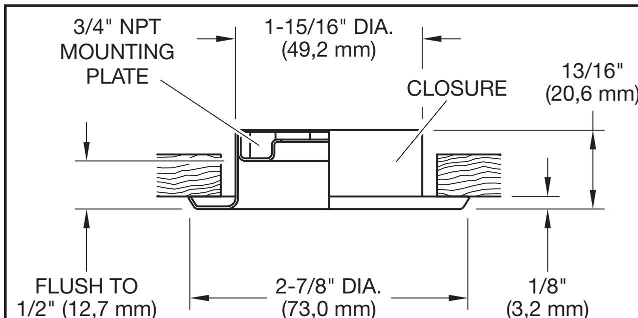


FIGURE 4
STYLE 30 RECESSED ESCUTCHEON
3/4 IN. NPT - 1/2 IN. ADJUSTMENT

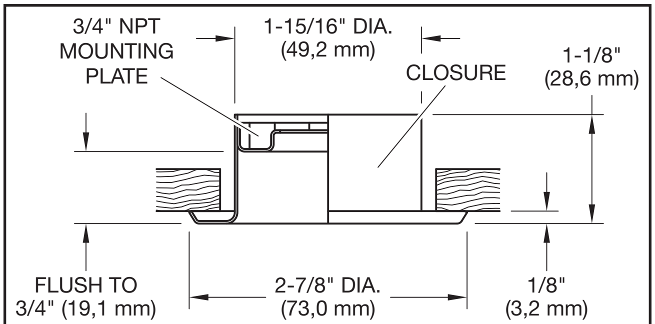


FIGURE 5
STYLE 40 RECESSED ESCUTCHEON
3/4 IN. NPT - 3/4 IN. ADJUSTMENT

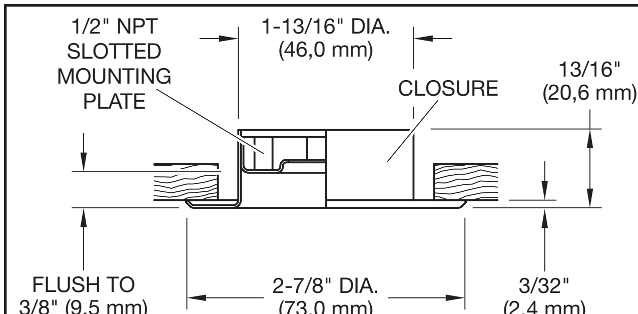


FIGURE 6
STYLE 50 RECESSED ESCUTCHEON
1/2 IN. NPT - 3/8 IN. ADJUSTMENT

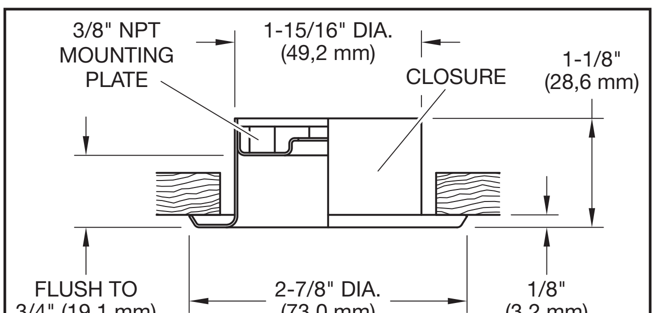


FIGURE 7
STYLE 70 RECESSED ESCUTCHEON
3/8 IN. NPT - 3/4 IN. ADJUSTMENT

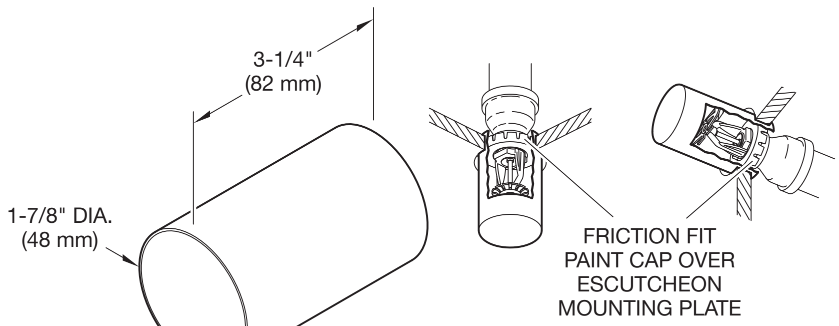


FIGURE 8
MODEL Z-392 PROTECTIVE PAINT CAP
FOR USE WITH STYLE 10, 15, 20, 30, 40, OR 70
RECESSED ESCUTCHEON

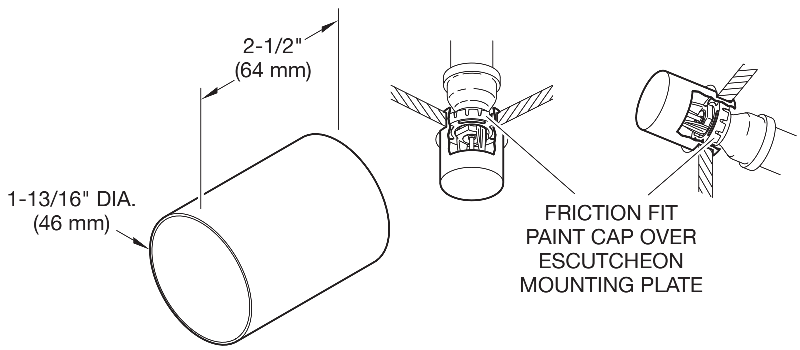


FIGURE 9
MODEL Z-84 PROTECTIVE PAINT CAP
FOR USE WITH STYLE 50 RECESSED ESCUTCHEON

Recessed Escutcheon Installation

Installation information for the Style 10, 15, 20, 30, 40, 50, and 70 Recessed Escutcheons is provided in individual pendent and horizontal sidewall sprinkler data sheets, as applicable. These data sheets also include details of recessed sprinkler installations.

Note: *The Style 10, 15, 20, 30, 40, 50, and 70 Recessed Escutcheons must only be used with the sprinklers for which they have been specifically laboratory approved by UL, C-UL, ULC, or FM.*

Protective Paint Cap Installation

With reference to Figures 8 and 9, push the Protective Paint Cap over the Mounting Plate of the Recessed Escutcheon in lieu of the Closure.

After the ceiling or wall finish is complete, remove the Protective Paint Cap and install the Closure.

The Protective Paint Cap may be discarded as a plastic commodity or Low Density Polyethylene Recycling Category 4, in conformance with local regulations. Alternatively, the Protective Paint Cap may be reused.

Note: *The sprinkler cannot operate properly with the Protective Paint Cap in place.*

Care and Maintenance

Specific requirements of the NFPA must be performed, and any impairment must be immediately corrected.

Absence of an escutcheon to cover a clearance hole can delay the sprinkler operation in a fire situation.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the NFPA, such as NFPA 25, in addition to the standards of any authority having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

Automatic sprinkler systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Protective Paint Cap
Specify: Model (specify) Protective Paint Cap, P/N (specify):

Model Z-84. 56-711-1-084
Model Z-392. 92-000-0-412

Recessed Escutcheon
Specify: Style (specify) Recessed Escutcheon, (specify Carbon Steel or Stainless Steel), (specify) finish, P/N (specify):

Carbon Steel

Style 10
1/2 in. NPT (15 mm), 3/4 in. (19,1 mm) total adjustment

Brass Plated. 56-701-2-010
Pure White (RAL9010)*. 56-701-3-010
Signal White (RAL9003). 56-701-4-010
Jet Black (RAL9005) 56-701-6-010
Chrome Plated 56-701-9-010

Style 15
1/2 in. NPT (15 mm), 5/8 in. (15,9 mm) total adjustment

Brass Plated. 56-715-2-010
Pure White (RAL9010)*. 56-715-3-010
Signal White (RAL9003). 56-715-4-010
Jet Black (RAL9005) 56-715-6-010
Chrome plated 56-715-9-010

Style 20
1/2 in. NPT (15 mm), 1/2 in. (12,7 mm) total adjustment

Brass Plated. 56-705-2-010
Pure White (RAL9010)*. 56-705-3-010
Signal White (RAL9003). 56-705-4-010
Jet Black (RAL9005) 56-705-6-010
Chrome Plated 56-705-9-010

Style 30
3/4 in. NPT (20 mm), 1/2 in. (12,7 mm) total adjustment

Brass Plated. 56-705-2-011
Pure White (RAL9010)*. 56-705-3-011
Signal White (RAL9003). 56-705-4-011
Jet Black (RAL9005) 56-705-6-011
Chrome Plated 56-705-9-011

Style 40
3/4 in. NPT (20 mm), 3/4 in. (19,1 mm) total adjustment

Brass Plated. 56-700-2-010
Pure White (RAL9010)*. 56-700-3-010
Signal White (RAL9003). 56-700-4-010
Jet Black (RAL9005) 56-700-6-010
Chrome Plated 56-700-9-010

Style 50
1/2 in. NPT (15 mm), 3/8 in. (9,5 mm) total adjustment

Brass Plated. 56-711-2-010
Pure White (RAL9010)*. 56-711-3-010
Signal White (RAL9003). 56-711-4-010
Chrome Plated 56-711-9-010

Style 70
For use with TY-B and TY-FRB 10 mm orifice sprinklers only. Refer to data sheet TFP670

3/8 in. NPT (10 mm), 3/4 in. (9,1 mm) total adjustment

ANZ only:

Signal White (RAL9003). ECPL2PW10
Chrome Plated ECPL2PC10
Brass ECPL2PB10
Jet Black (RAL9005) ECPL2PBL10

EMEA only:

Pure White (RAL9010)*. ESCSTDRA10
Signal White (RAL9003). ESCSTDWH10
Chrome Plated ESCSTDCH10
Brass ESCSTDBR10
Jet Black (RAL9005) ESCSTDJB10

* Eastern Hemisphere sales only

Stainless Steel

Style 10
1/2 in. NPT (15 mm), 3/4 in. (19,1 mm) total adjustment

Signal White (RAL9003). 56-701-0-010
Plain Unpolished 56-701-1-010
Grey Aluminum (RAL9007) 56-701-7-010

Style 15
1/2 in. NPT (15 mm), 5/8 in. (15,9 mm) total adjustment

Signal White (RAL9003). 56-715-0-010

Style 20
1/2 in. NPT (15 mm), 1/2 in. (12,7 mm) total adjustment

Signal White (RAL9003). 56-705-0-010
Plain Unpolished 56-705-1-010

Style 30
3/4 in. NPT (20 mm), 1/2 in. (12,7 mm) total adjustment

Signal White (RAL9003). 56-705-0-011
Plain Unpolished 56-705-1-011

Style 40
3/4 in. NPT (20 mm), 3/4 in. (19,1 mm) total adjustment

Signal White (RAL9003). 56-700-0-010
Plain Unpolished 56-700-1-010
Grey Aluminum (RAL9007) 56-700-7-010

Style 50
1/2 in. NPT (15 mm), 3/8 in. (9,5 mm) total adjustment

Signal White (RAL9003). 56-711-0-010
Plain Unpolished 56-711-1-010

Style 70
For use with TY-B and TY-FRB 10 mm orifice sprinklers only, refer to data sheet TFP670

3/8 in. NPT (10 mm), 3/4 in. (9,1 mm) total adjustment

ANZ only:

Plain Unpolished ECPL2PS10

EMEA only:

Plain Unpolished ESCSTDSS10