ENW STRUCTURAL ENGINEERS
Engineers Northwest Inc., P.S.

Reviewed 2/15/2022 DLSubject to field inspectors approvals.

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COSTCO WHOLESALE

1201 39th Avenue SW
Puyallup, WA

STRUCTURAL CALCULATIONS FOR HVAC REMODEL

THE APPROVED CONSTRUCTION PLANS AND ALL ENGINEERING DOCUMENTS MUST BE POSTED ON THE JOB AT ALL INSPECTIONS IN A VISIBLE AND READILY ACCESSIBLE LOCATION.

2018 International Building Code
December 21, 2021
ENW #99090013

B-21-0421

9725 Third Avenue NE, Suite 207
Seattle, WA 98115
206.525.7560 . fax 206.522.6698
www.engineersnw.com

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ENW ENGINEERS NORTHWEST, INC., P.S. ~ STRUCTURAL ENGINEERS

9725 THIRD AVE NE, SUITE 207, SEATTLE, WA 98115 (206) 525~7560 FAX (206) 522~6698

PROJECT # 99090013 PROJECT C. PUYALLUP. WA. DATE 3/31/2021

SUBJECT HVAC REPLACEMENT. SHEET ____ OF ____

BY RZ

- DESCRIPTION: REPLACE EXISTING HVAC UNIT
- CODE: 2018 IBC
- EXISTING LOADING LL = 25 PSF DL = 12 PSF. → 37 PSF x 5' = 185 PLF
  USE 192 PLF FROM SPAN DRAWING
- NEW LOADING LL = 25 PSF DL = 10 PSF. (MINUS 2 PSF MECHANICAL WEIGHT) → 35 x 5' = 175 PLF.

	(E) WEIGHT	NEW WEIGHT		
AC-1	835#	350#	7'	31'
AC-2	1093	350#	22'	36'
AC-4	1342	1866#	EXISTING DESIGN 1800#	
AC-5	748	350#	9'	43'

1866 66/1800 = 3.6% < 5% OK.

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PROJECT # _____ PROJECT _____ DATE _____

SUBJECT _____ SHEET _____ OF _____

_____ BY _____

	(E)	(N)		
AC-6.	748	350 #	22'	36'
AC-7.11.	8300#	818		
8.9.10.	4	3	17'	36'
	2075	2727.	< 3900#	OK.

ORIGINAL DESIGN. LOAD.

AC-12 NEW UNIT. 3701 #.

5' 36'

3701 / 3 / 2 = 617 #

420x6 = 2520 # MAX

N. G.

GIRDER AND COL. OK.

B-21-0421

B-21-0421

(NEW) 12-21/24.

HVAC EQUIPMENT SCHEDULE–S.O.I.C.

SYMBOL	ITEM	SERVES	MFR/#	DESCRIPTION	ELECT.	FAN HP	REFERENCE	REMARKS	NOTES	EXISTING UNIT DATA				STRUCTURAL VERIFICATION	
										MFR/#	HEAT	ELECTRICAL (V/ø/A)	NET WEIGHTS	NEW NET WEIGHTS	REMARKS
AH–1	SPLIT SYSTEM UNIT	PHARMACY	LG LVN361HV4	3 TON MULTI POSITION AIR HANDLING UNIT: HEAT PUMP 1000 CFM LIQUID LINE: 3/8", GAS LINE OD: 5/8" POWERED BY CU–1			PLAN ME–1 71/ME	AIR TRANSFERRED FROM MAIN SALES O/A FROM MAIN SALES UNITS	(72)	–	–	–	–	129#:UNIT 150#:DESIGN	NEW UNIT MOUNTED INDOOR SUSPENDED FROM STRUCTURE.
CU–1	SPLIT SYSTEM UNIT	PHARMACY	LG LUU369HV	3 TON MINI SPLIT SYSTEM CONDENSING UNIT 36 MBH HEAT PUMP SEER = 18, HSPF = 10	208V/1ø 40 MCOP 32 MCA		PLAN ME–1 70/ME		(58)	TRANE 2YCC3030A 1040A	NATURAL GAS 40 MBH	208V/1ø 25 MCOP 15.1 MCA	434 #:(E)UNIT 51 #:(E)CURB 350 #:(E)DUCT 835 #:(E)TOTAL	200#:UNIT 50#:CURB 100#:CURB 350#:TOTAL	NEW UNIT WEIGHS 485# LESS THAN EXISTING CONDITION
AH–2	SPLIT SYSTEM UNIT	OFFICE	LG LVN361HV4	3 TON MULTI POSITION AIR HANDLING UNIT: HEAT PUMP 1000 CFM LIQUID LINE: 3/8", GAS LINE OD: 5/8" POWERED BY CU–2			PLAN ME–1 71/ME	AIR TRANSFERRED FROM MAIN SALES O/A FROM MAIN SALES UNITS	(72)	–	–	–	–	129#:UNIT 150#:DESIGN	NEW UNIT MOUNTED INDOOR SUSPENDED FROM STRUCTURE.
CU–2	SPLIT SYSTEM UNIT	OFFICE	LG LUU369HV	3 TON MINI SPLIT SYSTEM CONDENSING UNIT 36 MBH HEAT PUMP SEER = 18, HSPF = 10	208V/1ø 40 MCOP 32 MCA		PLAN ME–1 70/ME		(59)	TRANE YCD036C4 LGAA	NATURAL GAS 80 MBH	460V/3ø 15 MCOP 10 MCA	661 #:(E)UNIT 82 #:(E)CURB 350 #:(E)DUCT 1093 #:(E)TOTAL	200#:UNIT 50#:CURB 100#:CURB 350#:TOTAL	NEW UNIT WEIGHS 743# LESS THAN EXISTING CONDITION
AC–4	AIR CONDITIONER	TIRE SALES	AAON RN–006–30 BB02–222	67 MBH TOTAL COOLING, 48 MBH SENSIBLE, 82.2°F AMB, 77.5°F EDB, 65.2 °F EWB, 2400 CFM @ 0.5" ESP, SEER = 14.3, 90 MBH INPUT, 72.9MBH OUTPUT, 81% AFUE	460V/3ø 20 MOCP 13 FLA		PLAN ME–1 60/ME	500 CFM MIN O/A SINGLE ZONE VAV	(4) (55)(57) (64)(77)	TRANE YCD075C4 LGAA	NATURAL GAS 120 MBH	460V/3ø 25 MCOP 17.7 MCA	790 #:(E)UNIT 82 #:(E)CURB 470 #:(E)DIFF 1342 #:(E)TOTAL	1188 #:NEW UNIT 82 #:(E)CURB 184 #:ADAPTER 275 #:NEW DIFF. 1866 #:NEW DESIGN	NEW UNIT WEIGHTS 524# MORE THAN EXISTING CONDITION
AH–5	SPLIT SYSTEM UNIT	OPTICAL	LG LVN241HV4	2 TON MULTI POSITION AIR HANDLING UNIT: HEAT PUMP 710 CFM LIQUID LINE: 3/8", GAS LINE OD: 5/8" POWERED BY CU–5			PLAN ME–1 71/ME	AIR TRANSFERRED FROM MAIN SALES O/A FROM MAIN SALES UNITS	(72)	–	–	–	–	129#:UNIT 150#:DESIGN	NEW UNIT MOUNTED INDOOR SUSPENDED FROM STRUCTURE.
CU–5	SPLIT SYSTEM UNIT	OPTICAL	LG LUU249HV	2 TON MINI SPLIT SYSTEM CONDENSING UNIT 24 MBH HEAT PUMP SEER = 19.5, HSPF = 11	208V/1ø 30 MCOP 20 MCA		PLAN ME–1 70/ME		(58)	TRANE YCC018F1 L0BA	NATURAL GAS 40 MBH	208V/1ø 20 MCOP 13.2 MCA	347 #:(E)UNIT 51 #:(E)CURB 350 #:(E)DUCT 748 #:(E)TOTAL	200#:UNIT 50#:CURB 100#:CURB 350#:TOTAL	NEW UNIT WEIGHS 398# LESS THAN EXISTING CONDITION
AH–6	SPLIT SYSTEM UNIT	EDP	LG LVN241HV4	2 TON MULTI POSITION AIR HANDLING UNIT: HEAT PUMP 600 CFM LIQUID LINE: 3/8", GAS LINE OD: 5/8" POWERED BY CU–6			PLAN ME–1 71/ME	AIR TRANSFERRED FROM MAIN SALES O/A FROM MAIN SALES UNITS	(72)	–	–	–	–	129#:UNIT 150#:DESIGN	NEW UNIT MOUNTED INDOOR SUSPENDED FROM STRUCTURE.
CU–6	SPLIT SYSTEM UNIT	EDP	LG LUU249HV	2 TON MINI SPLIT SYSTEM CONDENSING UNIT 24 MBH HEAT PUMP SEER = 19.5, HSPF = 11	208V/1ø 30 MCOP 20 MCA		PLAN ME–1 70/ME		(58)	TRANE YCC018F1 L0BA	NATURAL GAS 40 MBH	208V/1ø 20 MCOP 13.2 MCA	347 #:(E)UNIT 51 #:(E)CURB 350 #:(E)DUCT	200#:UNIT 50#:CURB 100#:CURB	NEW UNIT WEIGHS 398# LESS THAN EXISTING CONDITION
AC–7,11	AIR CONDITIONER	MAIN SALES HIGH HEAT	AAON RN–050–30 BQ04–2C2	531 MBH TOTAL COOLING, 413 MBH SENSIBLE, 82.2°F AMB, 78.0°F EDB, 61.0 °F EWB, 18500 CFM @ 0.5" ESP, EER = 10.6, 540 MBH INPUT, 437.4MBH OUTPUT, 81% AFUE	460V/3ø 125 MOCP 119 MCA		PLAN ME–1 60/ME	MIN 2000 CFM O/A UP TO 3500 CFM BASED ON CO2 LEVELS	(8) (55)(60) (77)(78)	TRANE YCD600A4 LA1A4DD1B	NATURAL GAS 400 MBH	480V/3ø ~~~ MCOP 136 MCA	8300 #:(E)DESIGN	6230 #:NEW UNIT 365 #:(E)CURB 786 #:ADAPTER 800 #:NEW DIFFUSER 8181 #:NEW TOTAL	NEW UNIT WEIGHTS 119# LESS THAN EXISTING CONDITION
AC–8,9, 10	AIR CONDITIONER	MAIN SALES HIGH HEAT	AAON RN–050–30 BQ04–2C2	531 MBH TOTAL COOLING, 413 MBH SENSIBLE, 82.2°F AMB, 78.0°F EDB, 61.0 °F EWB, 18500 CFM @ 0.5" ESP, EER = 10.6, 540 MBH INPUT, 437.4MBH OUTPUT, 81% AFUE	460V/3ø 125 MOCP 119 MCA		PLAN ME–1 60/ME	MIN 2000 CFM O/A UP TO 3500 CFM BASED ON CO2 LEVELS	(8) (55)(60) (78)	TRANE YCD600A4 LA1A4DD1B	NATURAL GAS 400 MBH	480V/3ø ~~~ MCOP 136 MCA	8300 #:(E)DESIGN	6230 #:NEW UNIT 365 #:(E)CURB 786 #:ADAPTER 800 #:NEW DIFFUSER 8181 #:NEW TOTAL	NEW UNIT WEIGHTS 119# LESS THAN EXISTING CONDITION

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COPY OF EXISTING DRAWING

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ALL STRUT JOIST DESIGNED FOR 33 KIPS BOTTOM CHORD AXIAL LOAD.

(6) DESIGN LOADS:

LIVE LOAD = 25 PSF (LIVE LOAD)
DEAD LOAD = 1.5 PSF (ROOF)
DEAD LOAD = 2.5 PSF (JOIST & BRIDGING BY SMI)
COLLATERAL LOAD = 8.0 PSF OR (6.5 + SPRINKLER LOAD)
GROSS WIND UPLIFT = 26.3 PSF (TYP. U.N.O.)
GROSS WIND UPLIFT = 46.3 PSF (AT 10'-0 EDGE ZONES)
NET WIND UPLIFT = 23.3 PSF (TYP. U.N.O.)
NET WIND UPLIFT = 43.3 PSF (AT 10'-0" EDGE ZONES)

"INCREASE ALL DESIGN LOADS BY 1.5%."

(7) DESIGN NOTES:

NET UPLIFT = -119 PLF

TOP CHORDS ARE LATERALLY SUPPORTED BY THE DECK
FOR DEAD PLUS LIVE LOADS ONLY.
TOP CHORDS ARE UNSUPPORTED IN UPLIFT CONDITIONS ONLY.
1/3 STRESS INCREASE IN WIND & SEISMIC STRESSES ALLOWED.
DEFLECTION = L/240
JOIST PANELS TO ALLIGN PER BAY.
HOLD DEFAULT END PANELS FOR NON-STRUT JOIST FOR BCX LENGTH.
ALL JOIST ARE 24" DEEP.
ALL JOIST SEATS TO BE 2 1/2" DEEP, 4" LONG, AND BOLTED.(U.N.O.)
NO BOLTING @ SKEWED FRAME, WELD SEATS.
ALL SEAT SLOTS TO BE 9/16" x 2" LONG W/3 1/4" GAUGE.
ALL BRIDGING IS TO BE BOLTED.(OR FIELD WELDED AS NEEDED)

(8) JOIST LOADING:

UNITS = PLF TOTAL LOAD/LIVE LOAD/UPLIFT

TYPICAL JOIST TYPE IS,

24KS192/127/-119

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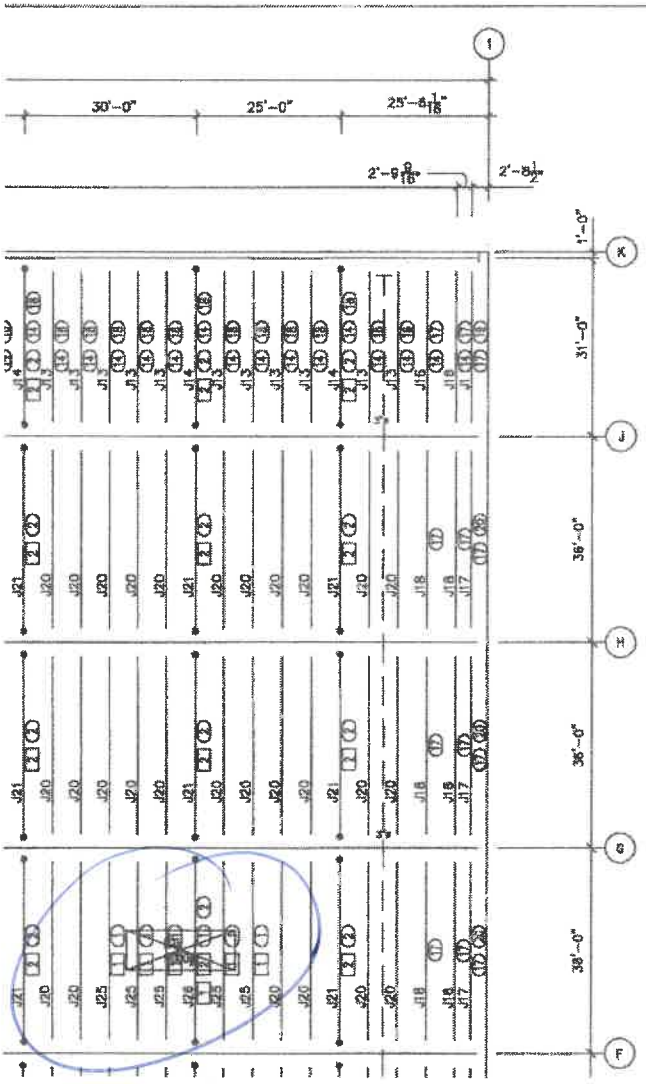

SPECIAL DRAWING NOTES:

[1] = 100% STRESS REVERSAL.

[2] = MINIMUM BOTTOM CHORD MATERIAL = 2.5" x 2.5" x .25" NO FILLS WITHIN 1'-0 FROM END OF BOTTOM.

SPECIAL JOIST LOADS:

No.	Cat	T/B	Plcs	Dir	Load1	Dist1	Load2	Dist2	Ref	Remarks
(1)	DL	T	Conv	Y	3900				L	(2;1950#) RTU
(2)	EL	B	Chd	X	33600				L	STRUT
	WL	B	Chd	Y	31100				L	STRUT
(3)	DL	T	Uni	Y	35		35		L	8" PIPE
(4)	DL	T	Uni	Y	70		70		L	8"+8" PIPE
(5)	DL	T	Uni	Y	22		22		L	6" PIPE
(6)	CL	T	Conv	Y	2080				L	(4;520#) PIPE
(7)	CL	T	Conv	Y	1560				L	(3;520#) PIPE
(8)	CL	T	Conv	Y	1040				L	(2;520#) PIPE
(10)	CL	T	Conv	Y	325				L	6" PIPE
(11)	CL	T	Conv	Y	175				L	SMALL PIPES
(14)	SL	T	Uni	Y	0	4'-9"	104	0"	R	DRIFT(Main)
(17)	WL	T	Uni	Y	-220		-220		L	Full Strip Uplift
(18)	WL	T	Uni	Y	-101	10'-0"	-101	0"	R	Addnl Strip Uplift
(19)	SL	T	Uni	Y	0	2'-11"	64	0"	R	Corner Drift (Main)
	SL	T	Uni	Y	40		40		L	Side Drift
(20)	SL	T	Uni	Y	40		40		L	Uniform Drift Load
(23)	SL	T	Uni	Y	207		207		L	Condenser Drift
(25)	WL	T	Uni	Y	-76	14'-2"	-76	0"	R	Addnl. Strip Lift (Skew)
(26)	SL	T	Uni	Y	104		104		L	Skew Drift

OTHER DRAWING NOTES:

(1) SEE SHEET J1.0 FOR ERECTION NOTES.

(2) TAG END OF ALL JOIST (U.N.O.) IS TOWARD THE BOTTOM OF THIS SHEET. NOTED OTHERWISE AT BAY A–B AND BAY D–E, TAG END OF JOIST TOWARD THE TOP OF THIS SHEET.
JOIST MARK INDICATES TAGGED END

(3) FLANGE WIDTHS:
INTERIOR FLANGE WIDTHS = 5 1/2" MIN. TO 8 1/2" MAX.
EXTERIOR FLANGE WIDTHS = 5" MIN. TO 6" MAX.
SKEWED FRAME FLANGE WIDTHS = 6"

(4) —— —— —— INDICATES SPRINKLER MAIN

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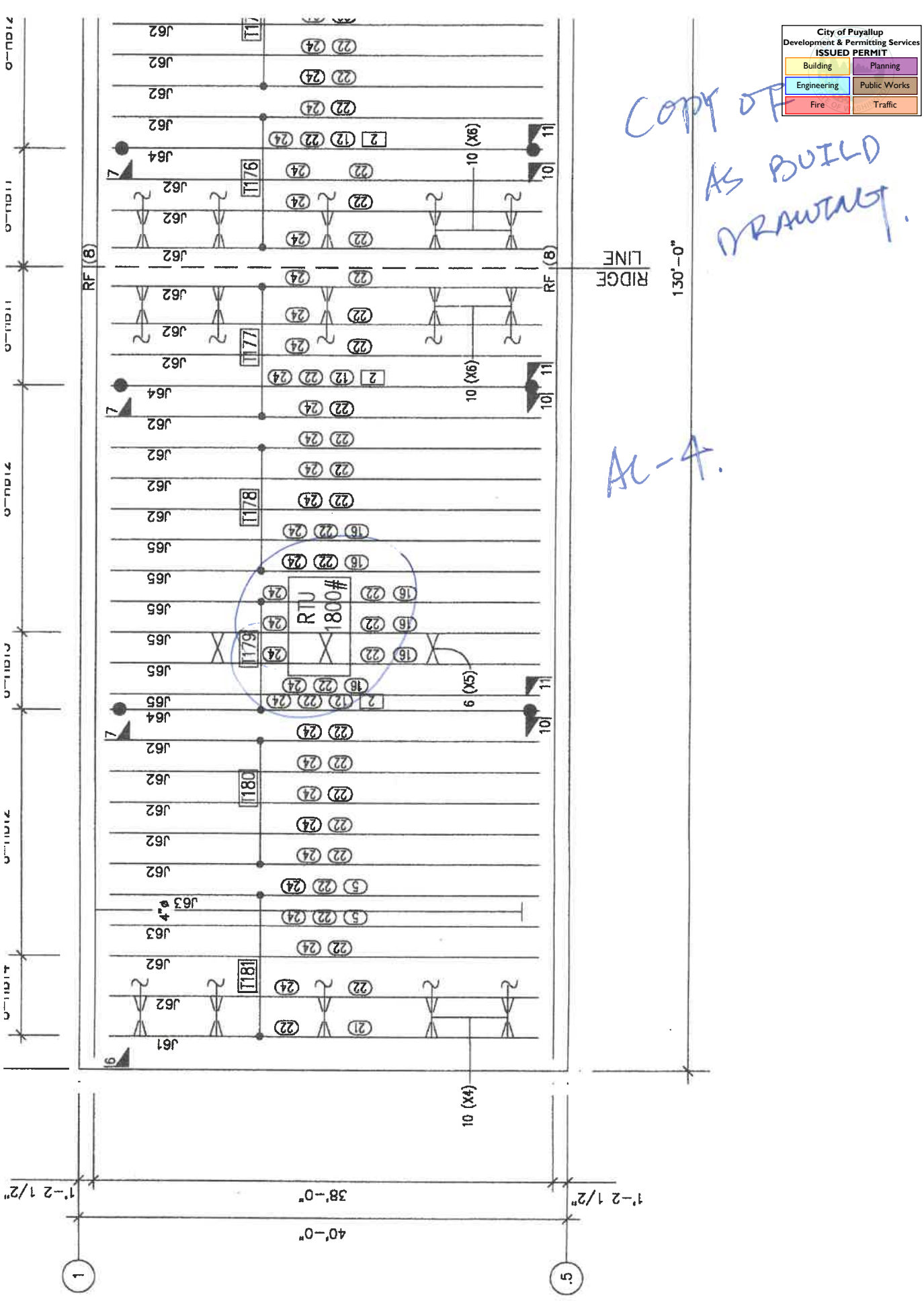
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COPY OF
AS BUILD
DRAWING.
A1-4.
RIDGE LINE
130'-0"
RF
RTU 1800#
T176
T177
T178
T179
T180
T181
10 (X6)
6 (X5)
10 (X4)
38'-0"
40'-0"
1'-2 1/2"
1'-2 1/2"
1
5

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ATC Hazards by Location

Search Information

Address:	1201 39th Ave SW, Puyallup, WA 98373
Coordinates:	47.1572713, -122.3083916
Elevation:	374 ft
Timestamp:	2021-03-05T06:47:17.540Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default

Basic Parameters

Name	Value	Description
S_S	1.268	MCE_R ground motion (period=0.2s)
S_1	0.438	MCE_R ground motion (period=1.0s)
S_{MS}	1.522	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.014	Numeric seismic design value at 0.2s SA
S_{D1}	* null 0.549	Numeric seismic design value at 1.0s SA

0.438 (1.25) = 0.823 (2/3) = 0.549.

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.914	Coefficient of risk (0.2s)
CR_1	0.898	Coefficient of risk (1.0s)
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration

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T_L	6	Long-period transition period (s)
SsRT	1.268	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.388	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.438	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.487	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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Hazards by Location

Search Information

Address: 1201 39th Ave SW, Puyallup, WA 98373

Coordinates: 47.1572713, -122.3083916

Elevation: 374 ft

Timestamp: 2021-03-05T06:47:03.821Z

Hazard Type: Wind

ASCE 7-16		ASCE 7-10		ASCE 7-05	
MRI 10-Year	67 mph	MRI 10-Year	72 mph	ASCE 7-05 Wind Speed	85 mph
MRI 25-Year	73 mph	MRI 25-Year	79 mph		
MRI 50-Year	78 mph	MRI 50-Year	85 mph		
MRI 100-Year	82 mph	MRI 100-Year	91 mph		
Risk Category I	92 mph	Risk Category I	100 mph		
Risk Category II	97 mph	Risk Category II	110 mph		
Risk Category III	104 mph	Risk Category III-IV	115 mph		
Risk Category IV	108 mph				

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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V1.0 4-4-2020

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ASCE 7-16
Seismic Loads per ASCE 7-16- Chapter 13 Seismic Design Requirements for Nonstructural Components

Project Name:
Location:

ASCE 7-16 Section 13.6 Seismic Demands on Nonstructural Components

All references below are to ASCE 7-16 (U.N.O.)

	Input	
Mechanical and Electrical Component =	Air-side HVAC, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxe	
Table 13.6-1 Category =	Mechanical and Electrical Components	
S_s =	1.268	
S_1 =	0.438	
Site Class (soil) =	D	
Risk Category =	II	Table 1.5-1
Average roof height of structure, h =	23.5	ft
Height in structure of point of attachment of component with respect to base, z =	23.5	ft
Component importance factor, I_p =	1.0	Sect 13.1.3
Operating weight of mechanical unit, W_p =	8181	lb.

	Output	
Site Coefficient, F_a =	1	Table 11-4.1
S_{MS} =	1.268	Eqn 11.4-1
S_{DS} =	0.85	Eqn 11.4-3
z/h =	1	
Component amplification factor, a_p =	2.5	
Component response modification factor, R_p =	6	
Component overstrength factor, Ω_o =	2	
F_p =	0.423	* W_p, Eqn 13.3-1
F_{p_max} =	1.353	* W_p, Eqn 13.3-2
F_{p_min} =	0.254	* W_p, Eqn 13.3-3
F_{p_horiz} =	0.423	* W_p
F_{p_horiz} =	**3460.6**	**lb (ULT)**
F_{p_vert} = +/-	0.169	* W_p, Sect. 13.3.1.2 (apply concurrently with horizontal force)
F_{p_vert} = +/-	**1382.6**	**lb (ULT), Sect 13.3.1 (apply concurrently with horizontal force)**

NOTES:
1. Anchors in concrete shall be designed in accordance with Appendix D of ACI 318.
2. Anchors in masonry shall be designed in accordance with TMS 402/ACI 530/ASCE 5. Anchors shall be designed to be governed by the tensile or shear strength of a ductile steel element. See Sect 13.4.2.2 for exception.
3. Post-installed anchors in concrete shall be prequalified for seismic applications in accordance with ACI 355.2 or other approved qualification procedures. Post-installed anchors in masonry shall be prequalified for seismic applications in accordance with approved qualification procedures.
4. Power actuated fasteners in concrete or steel shall not be used for sustained tension loads or for brace applications in Seismic Design Categories D, E, or F unless approved for seismic loading. Power actuated fasteners in masonry are not permitted unless approved for seismic loading. See Section 13.4.5 for exceptions.
5. Friction clips in Seismic Design Categories D, E, or F shall not be used for supporting sustained loads in addition to resisting seismic forces.

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v 1.0 4-2-2020

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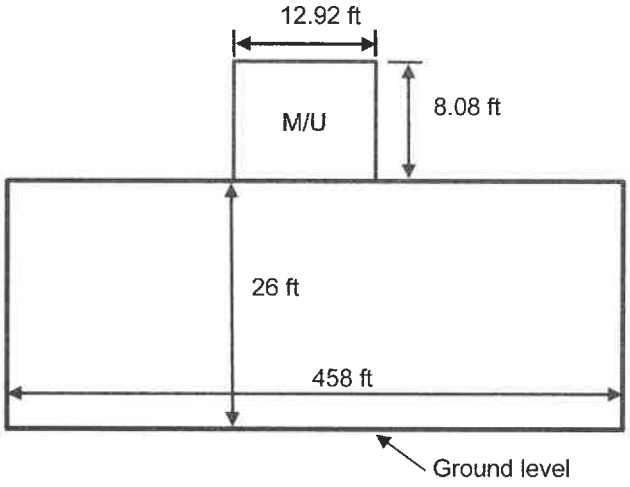
Wind Loads per ASCE 7-16- Chapter 29 Other Structures and Building Appurtenances- Rooftop Equipment

Project Name:
Location:

Program Limitations: 1. Mean roof height *h* less than or equal to 60 ft.

BUILDING, SITE, AND MECHANICAL UNIT INFORMATION

	INPUT	
Building width, B =	458	ft (perpendicular to wind)
Building length, L =	328	ft (parallel to wind)
Building eave height, h_e =	26	ft
Building ridge height, h_r =	29	ft
Roof slope, s =	0.25 in./ft.	= 1.19 degrees
Risk Category =	II	
Wind velocity, V =	97	mi/hr = 75 mi/hr
Exposure =	B	
Topographic factor, K_{zt} =	1	
Wind directionality factor, K_d =	0.85	
M/U width =	12.92	ft (perpendicular to wind)
M/U depth =	8.33	ft (parallel to wind)
M/U height =	8.08	ft



	OUTPUT			
Mean roof height, h =	26	ft		
Pressure exposure coeff, K_h =	0.7		Ke =	1.00
Velocity pressure, q_h =	14.33	psf		
$(GC_r)_{lateral}$ =	1.9			
Horizontal wind pressure, p_h =	27.2	psf (LRFD)		
Horizontal wind force, F_h =	2842.3	lb (LRFD)		
$(GC_r)_{uplift}$ =	1.5			
Vertical uplift wind pressure, p_v =	21.5	psf (LRFD)		
Vertical uplift wind force, F_v =	2313.4	lb (LRFD)		

NOTE: To convert to ASD multiply by 0.6

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SHEET

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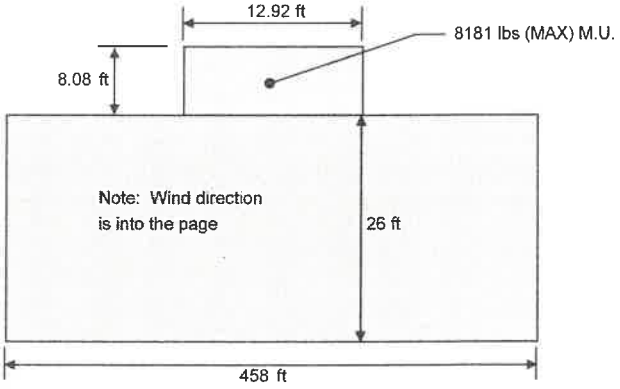
Lateral Loading on Mechanical Units

Input Cells =	
Project Number:	
Project Name:	
Location:	
Design By:	

Input

Mechanical and Electrical Component =	Air-side HVAC, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechani	
Table 13.6-1 Category =	Mechanical and Electrical Components	
Risk Category =	II	
Building Width =	458	ft
Roof height above ground level =	26	ft
Mechanical unit operating weight =	8181	lb
Mechanical unit length =	12.92	ft
Mechanical unit depth =	8.33	ft
Mechanical unit height =	8.08	ft
Holdown clearance, c_{HD} =	3	in



Seismic Parameters

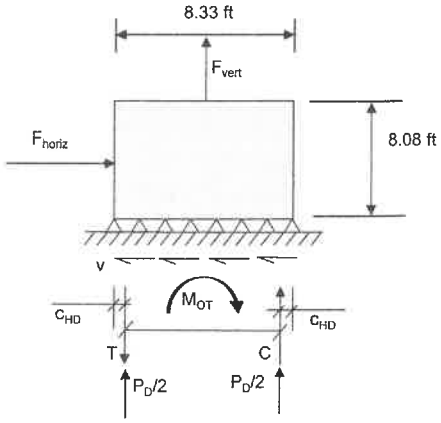
S_{DS} =	0.85	
Force inputted in =	LRFD	
Horizontal seismic force, F_{p_horiz} =	3460.6	lb
Vertical seismic force, F_{p_vert} =	1382.6	lb
Vertical center of mass of mech. unit, h =	4.04	ft

See seismic loads spreadsheet for additional data

Wind Parameters

Force inputted in =	LRFD	
Horizontal wind force, F_h =	2843	lb
Vertical uplift wind force, F_v =	2314	lb

See wind loads spreadsheet for additional data



Output

LATERAL LOADS AND REACTIONS	Ultimate (LRFD)	Working (ASD)
Seismic overturning moment =	13981 ft-lb	9787 ft-lb
Seismic uplift @ each end of unit =	0 lb	0 lb
Seismic shear @ each side of unit =	1730 lb	1211 lb
Wind overturning moment =	11486 ft-lb	8891 ft-lb
Wind uplift @ each end of unit =	0 lb	0 lb
Wind shear @ each side of unit =	1422 lb	853 lb

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RTU CONNECTION CHECK: INPUT

RTU CURB DIMS: 146 IN LENGTH 93 IN WIDTH

SHEAR CHECK: **(ASD)**

SHEAR DEMAND: 1211 LBS (SEE LATERAL LOADING FOR MECHANICAL UNITS SPREADSHEET)

USE 11/32" DIA SCREWS @ 6" O.C
CONNECTING MEMBER GAGE: 14 GAGE
SHEAR CAPACITY: 651 LBS CAPACITY OF SINGLE 1/4" DIA SCREWS PER SCREW SCHEDULE

NUMBER OF SCREWS REQ'D: 1211 / 651 = 2 SCREWS
CONNECTION LENGTH REQ'D:
6" + 6" (both sides) + 6 * 1 (screw spacing) = 18 IN

RTU SHORT SIDE LENGTH:	93 IN	>	18 IN	OK

UPLIFT CHECK: **(ASD)**

UPLIFT DEMAND: 0 LBS

USE 1/2" DIA A307 BOLT (TWO BOLTS EACH CORNERS, 8 BOLTS TOTAL)

BOLT CAPACITY: 22.5 KSI * 0.196 IN^2 = 4.41 K

TOTAL 4 BOLTS @ EACH SIDE TO TAKE THE UPLIFT FORCES:

TOTAL BOLT CAPACITY: 4 * 4.41 = 17.64 K

0 LBS	<	17.64 K	OK

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RN UNITS 26-70 TON

AAON®

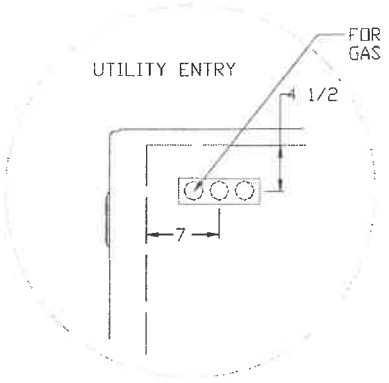
WITH ECONOMIZER

CLEARANCES

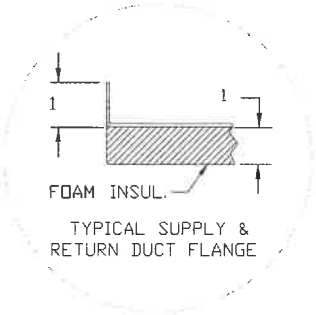
LOCATION	UNIT SIZE 26-70 TON
RETURN AIR BACK	48
VENT SIDE FRONT	48
LEFT SIDE	48
RIGHT SIDE	70
TOP	UNOBSTRUCTED

NOTE: RIGHT AND LEFT SIDE UNIT CLEARANCES ARE INTERCHANGEABLE ON UNITS THAT DO NOT HAVE THE HYDRONIC HEATING OPTION. (UNITS WITH HYDRONIC HEAT MUST HAVE 70" RIGHT SIDE ACCESS FOR SERVICE.)

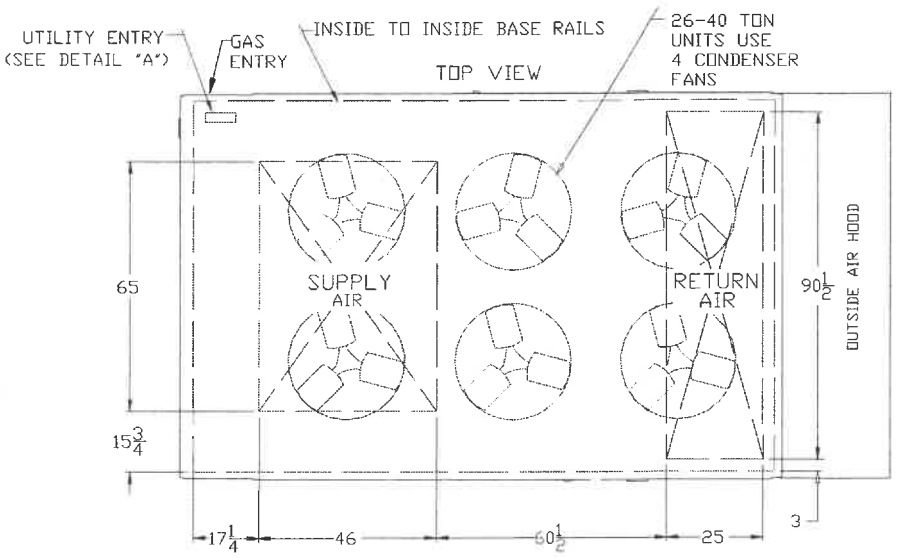
NOTE: 26-40 TON UNITS INCLUDES A SINGLE COOLING COIL. 50-70 TON UNIT INCLUDE TWO COOLING COILS.

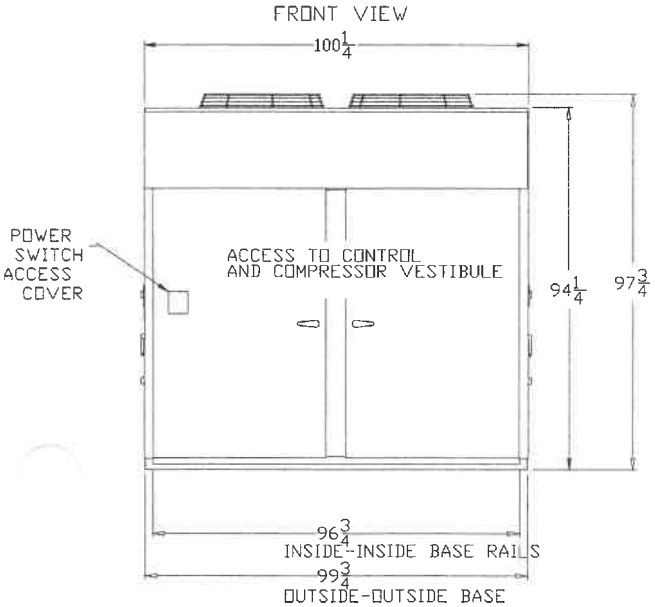


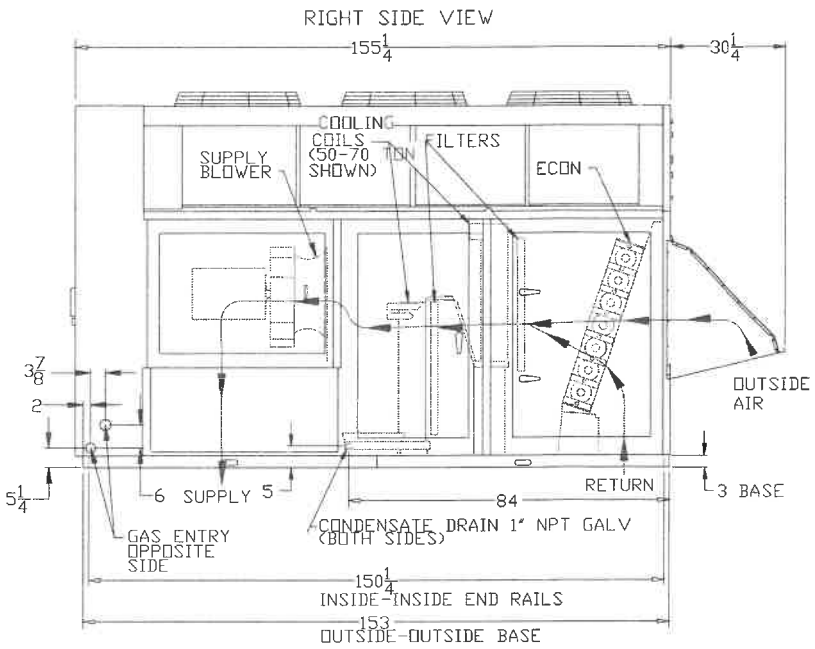
DETAIL A



DETAIL B







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ALL DIMENSIONS ARE IN INCHES

RND UNITS

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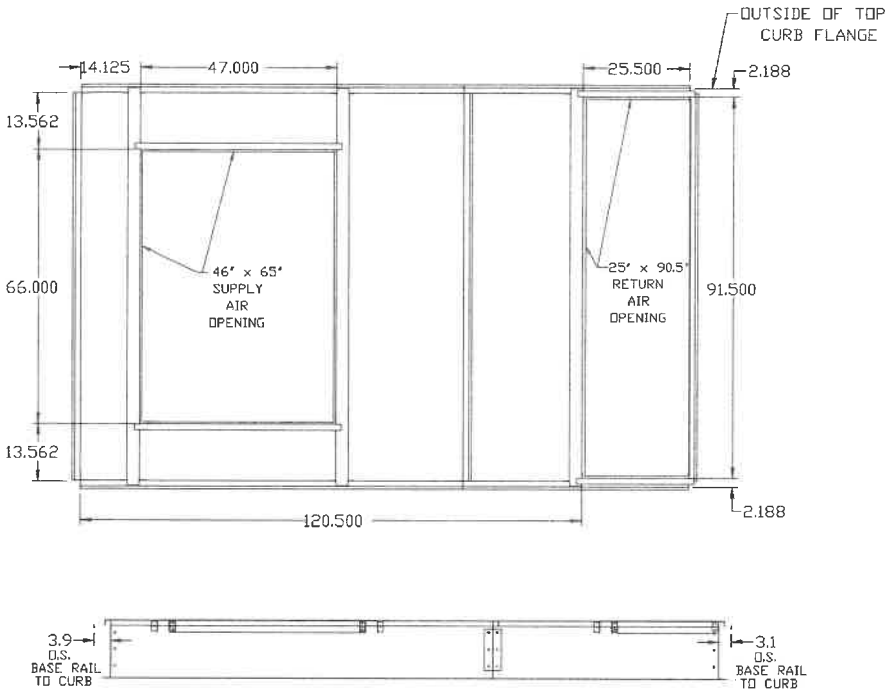
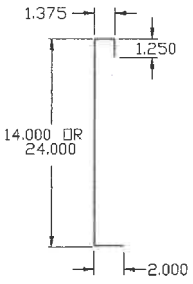
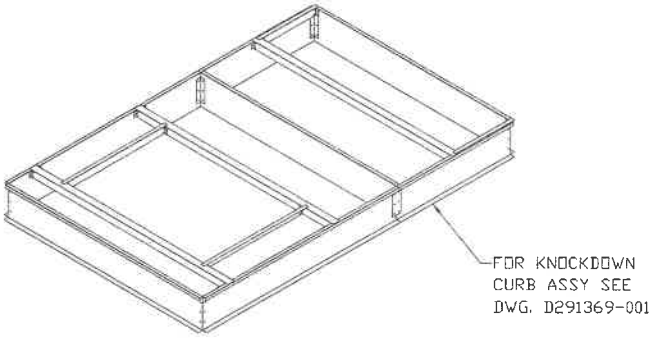
KNOCKDOWN CURB, STANDARD

KIT# K00779

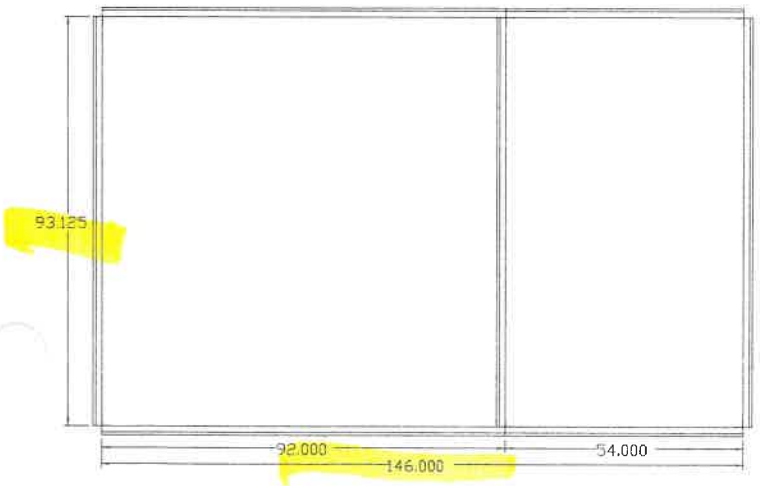


CURB WEIGHTS
14IN CURB=192LBS (234LBS WITH DUCT SUPPORT RAIL)
24IN CURB=291LBS (333LBS WITH DUCT SUPPORT RAIL)





CURB WITHOUT DUCT SUPPORT RAIL KIT



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RND-00057 REV: 10/02/18 JJS
NOTE: ALL DIMENSIONS ARE IN INCHES

STRUCTURAL CALCULATIONS

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PROJECT # 99090013 PROJECT C. PUYALLUP, WA. DATE 12/27/2021

SUBJECT HANGING UNIT CHECK. SHEET ____ OF ____

BY ____

- TO CHECK THE NEW HANGING UNITS.

AH-1	150#
AH-2	150#
AH-5	150#
AH-6	150#.

GRAVITY CHECK: 3/8" Φ ROD : 730# > 150#/4 = 38#.

5' P1000 : 680# x 0.5 x 0.85 x 0.82 = 237#

JOIST : SEE ATTACHED STEEL JOIST CHECK. > 75#.

LATERAL CHECK: 1050# > 47#. OK. OK.

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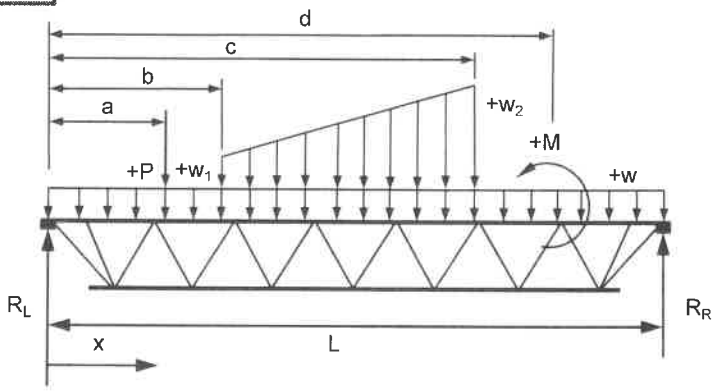
EXISTING STEEL JOIST ANALYSIS WITH NON-UNIFORM LOADS

Input =
Project Number =
Project Name = HVAC Replacement
Location =
Design By =

INPUT



JOIST INFO:

Joist Type =	K-Series	
Joist Designation =	24KS	
Span, L =	43	ft
Modulus of Elasticity, E =	29000	ksi
Moment of Inertia, I_x =	843	in^4

ORIGINAL DESIGN LOADS

Full Uniform:

w = 192 lb/ft

Point:

	a (ft)	P (lb)
1	15	0
2		
3		
4		
5		
6		
7		
8		

Distributed:

	Start b (ft)	Start w_1 (lb/ft)	End c (ft)	End w_2 (lb/ft)
1				
2				
3				
4				
5				

Moment:

	d (ft)	M (ft-lb.)
1		
2		
3		

NEW DESIGN LOADS

Full Uniform:

w = 175 lb/ft

Point:

	a (ft)	P (lb)
1	15	75
2		
3		
4		
5		
6		
7		
8		

Distributed:

	Start b (ft)	Start w_1 (lb/ft)	End c (ft)	End w_2 (lb/ft)
1				
2				
3				
4				
5				

Moment:

	d (ft)	M (ft-lb.)
1		
2		
3		

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OUTPUT

ORIGINAL DESIGN LOADS

End Reactions:

R_L = 4128 lbs. R_R = 4128 lbs.

Minimum Design Web Shear:

V_{W_MIN} = 1032.01 lbs. (25% of end reaction per SJI Specifications)

Maximum Moments:

$M^{(+)}_{MAX}$ = 44376 ft-lb @ x = 21.5 ft

$M^{(-)}_{MAX}$ = -4.13E-06 ft-lb @ x = 43 ft

Point of Zero Shear:

$x_{(V=0)}$ = 21.5 ft

Maximum Deflections:

$-\Delta_{MAX}$ = -0.69 in @ x = 21.5 ft

$+\Delta_{MAX}$ = 0 in @ x = 43 ft

Δ_{RATIO} = L/748

NEW DESIGN LOADS

End Reactions:

R_L = 3811.3372 lbs. R_R = 3788.66 lbs.

Maximum Moments:

$M^{(+)}_{MAX}$ = 41011.331 ft-lb @ x = 21.3505 ft

$M^{(-)}_{MAX}$ = -3.79E-06 ft-lb @ x = 43 ft

Point of Zero Shear:

$x_{(V=0)}$ = 21.35 ft

Note: If the location of the point of zero shear moves more than 1'-0" +/- between the original design loads and the new design loads, stress reversals could occur in the diagonal web members. If adjacent diagonal web members are not the same size, further detailed joist analysis would be required.

Maximum Deflections:

$-\Delta_{MAX}$ = -0.64 in @ x = 21.4748 ft

$+\Delta_{MAX}$ = 0 in @ x = 43 ft

Δ_{RATIO} = L/806

MAXIMUM STRESS RATIOS

ok.

U_{shear} = 0.948 @ x = 14.62 ft

$U_{bending}$ = 0.929 @ x = 13.76 ft

COMMENTS:

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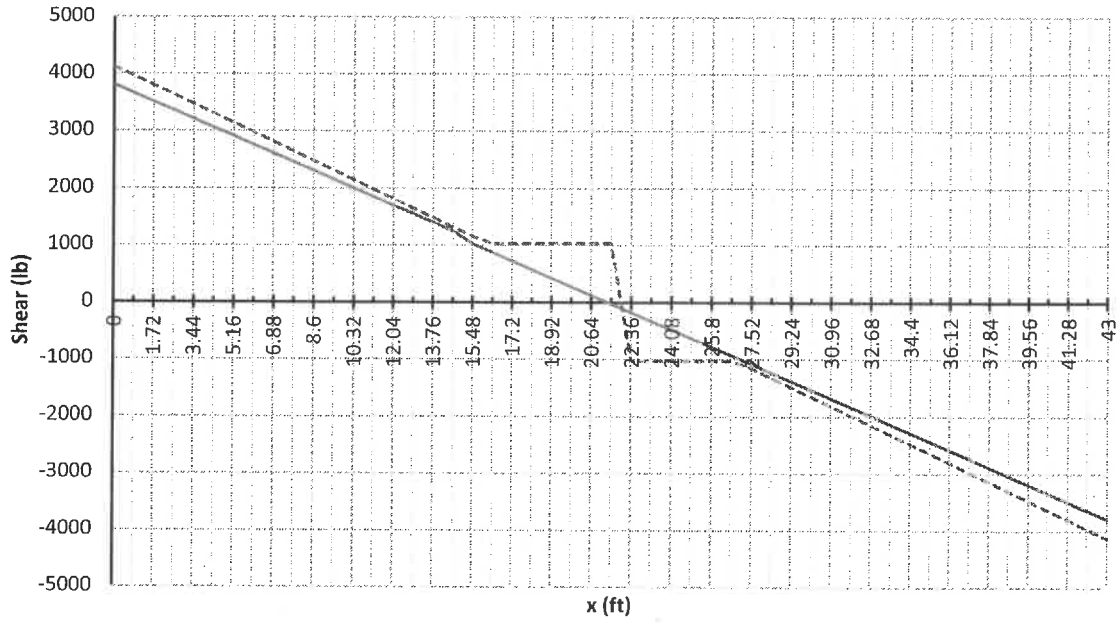
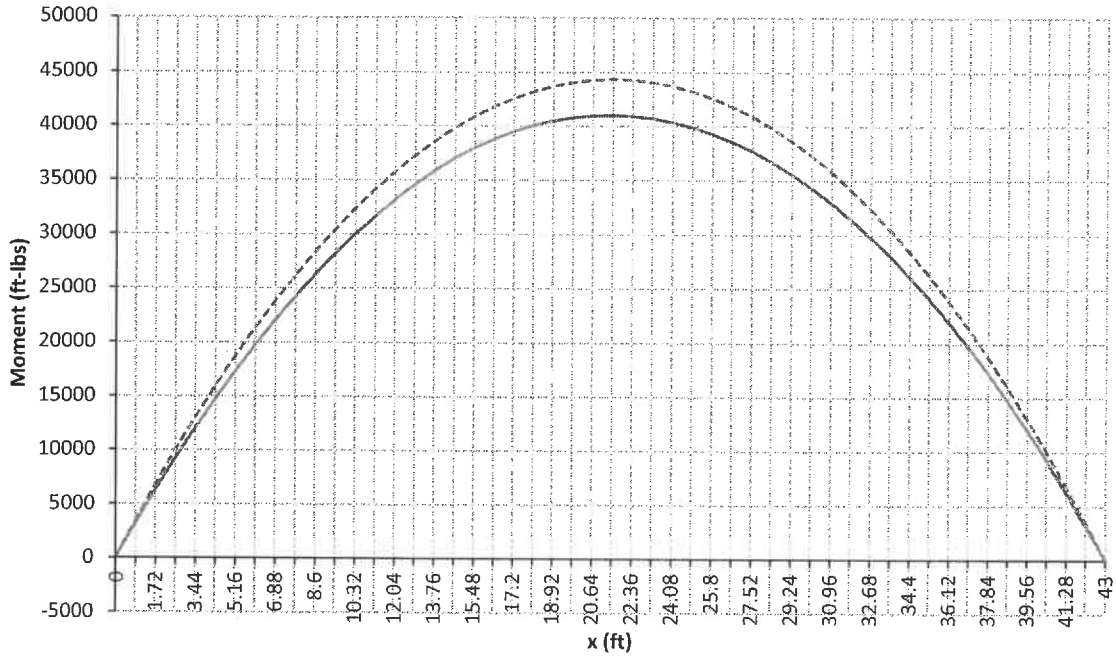
Shear Diagram



Moment Diagram



– – – – – – = curves for original design loads

——— = curves for new design loads

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12/21/2021
ExistJoistAnalysis

V1.0 4-4-2020

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ASCE 7-16
Seismic Loads per ASCE 7-16- Chapter 13 Seismic Design Requirements for Nonstructural Components

Project Name:
Location:

ASCE 7-16 Section 13.6 Seismic Demands on Nonstructural Components

All references below are to ASCE 7-16 (U.N.O.)

	Input	
Mechanical and Electrical Component =	Air-side HVAC, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxe	
Table 13.6-1 Category =	Mechanical and Electrical Components	
S_s =	1.268	
S_1 =	0.438	
Site Class (soil) =	D	
Risk Category =	II	Table 1.5-1
Average roof height of structure, h =	23.5	ft
Height in structure of point of attachment of component with respect to base, z =	14	ft
Component importance factor, I_p =	1.0	Sect 13.1.3
Operating weight of mechanical unit, W_p =	150	lb.

	Output	
Site Coefficient, F_a =	1	Table 11-4.1
S_{MS} =	1.268	Eqn 11.4-1
S_{DS} =	0.85	Eqn 11.4-3
z/h =	0.596	
Component amplification factor, a_p =	2.5	
Component response modification factor, R_p =	6	
Component overstrength factor, Ω_o =	2	
F_p =	0.309	* W_p, Eqn 13.3-1
F_{p_max} =	1.353	* W_p, Eqn 13.3-2
F_{p_min} =	0.254	* W_p, Eqn 13.3-3
F_{p_horiz} =	0.309	* W_p
F_{p_horiz} =	**46.4**	**lb (ULT)**
F_{p_vert} = +/-	0.169	* W_p, Sect. 13.3.1.2 (apply concurrently with horizontal force)
F_{p_vert} = +/-	**25.4**	**lb (ULT), Sect 13.3.1 (apply concurrently with horizontal force)**

NOTES:
1. Anchors in concrete shall be designed in accordance with Appendix D of ACI 318.
2. Anchors in masonry shall be designed in accordance with TMS 402/ACI 530/ASCE 5. Anchors shall be designed to be governed by the tensile or shear strength of a ductile steel element. See Sect 13.4.2.2 for exception.
3. Post-installed anchors in concrete shall be prequalified for seismic applications in accordance with ACI 355.2 or other approved qualification procedures. Post-installed anchors in masonry shall be prequalified for seismic applications in accordance with approved qualification procedures.
4. Power actuated fasteners in concrete or steel shall not be used for sustained tension loads or for brace applications in Seismic Design Categories D, E, or F unless approved for seismic loading. Power actuated fasteners in masonry are not permitted unless approved for seismic loading. See Section 13.4.5 for exceptions.
5. Friction clips in Seismic Design Categories D, E, or F shall not be used for supporting sustained loads in addition to resisting seismic forces.

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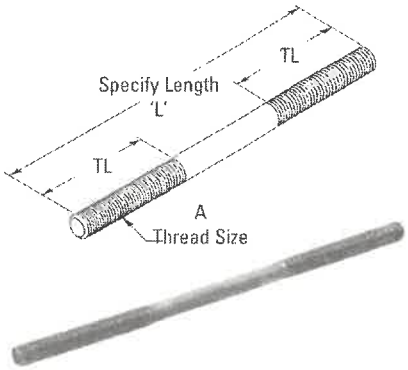
B3205 - Threaded Rod (right-hand threads - both ends)
B3205L - Threaded Rod (right & left hand threads)



Size Range: 3/8"-16 thru 3"-4 rod

Material: Steel

Function: Recommended for use as a hanger support in hanger assemblies. Rod is threaded on both ends with right hand threads of the length shown. Also available with left and right hand threads - specify Fig. B3205L when ordering.

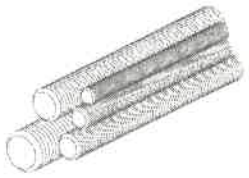
Maximum Temperature: 750°F (399°C)

Finish: Plain. Contact customer service for alternative finishes and materials.

Order By: Part number, rod size, length and finish

Part No.	Thread Size A	Standard Thread Length TL in.	(mm)	Design Load 650°F (343°C) Lbs.	(kN)	750°F (399°C) Lbs.	(kN)
B3205-3/8 x 'L'	3/8"-16	2 1/2"	(63.5)	730	(3.25)	572	(2.54)
B3205-1/2 x 'L'	1/2"-13	2 1/2"	(63.5)	1350	(6.00)	1057	(4.70)
B3205-5/8 x 'L'	5/8"-11	2 1/2"	(63.5)	2160	(9.61)	1692	(7.52)
B3205-3/4 x 'L'	3/4"-10	3"	(76.2)	3230	(14.37)	2530	(11.25)
B3205-7/8 x 'L'	7/8"-9	3 1/2"	(88.9)	4480	(19.93)	3508	(15.60)
B3205-1 x 'L'	1"-8	4"	(101.6)	5900	(26.24)	4620	(20.55)
B3205-1 1/8 x 'L'	1 1/8"-7	4 1/2"	(114.3)	7450	(33.14)	5830	(25.93)
B3205-1 1/4 x 'L'	1 1/4"-7	5"	(127.0)	9500	(42.25)	7440	(33.09)
B3205-1 1/2 x 'L'	1 1/2"-6	6"	(152.4)	13800	(61.38)	10807	(48.07)
B3205-1 3/4 x 'L'	1 3/4"-5	7"	(177.8)	18600	(82.73)	14566	(64.79)
B3205-2 x 'L'	2"-4 1/2	8"	(203.2)	24600	(109.42)	19625	(87.29)
B3205-2 1/4 x 'L'	2 1/4"-4 1/2	9"	(228.6)	32300	(143.67)	25295	(112.51)
B3205-2 1/2 x 'L'	2 1/2"-4	10"	(254.0)	39800	(177.03)	31169	(138.64)
B3205-2 3/4 x 'L'	2 3/4"-4	11"	(279.4)	49400	(219.73)	38687	(172.08)
B3205-3 x 'L'	3"-4	12"	(304.8)	60100	(267.32)	47066	(209.35)

ATR - All Threaded Rod 120" (3.05m) Lengths
Fig. 99 - All Threaded Rod Cut To Length



Size Range: 3/8"-16 thru 1 1/2"-6 rod in 120" (3.05m) lengths or cut to length

Material: Steel

Maximum Temperature: 750°F (399°C)

Finish: Plain. Contact customer service for alternative finishes and materials.

Order By: Part number, rod diameter and finish

Part No. - Size x Length ATR	Fig.99	Threads Per Inch	Recommended Load Lbs.	(kN)	Approx. Wt./100 Ft. Lbs.	(kg)
ATR 1/4" x 120	99-1/4" x length	20	240	(1.07)	12	(5.44)
ATR 3/8" x 120	99-3/8" x length	16	730	(3.24)	29	(13.15)
ATR 1/2" x 120	99-1/2" x length	13	1350	(6.00)	53	(24.04)
ATR 5/8" x 120	99-5/8" x length	11	2160	(9.60)	89	(40.37)
ATR 3/4" x 120	99-3/4" x length	10	3230	(14.37)	123	(55.79)
ATR 7/8" x 120	99-7/8" x length	9	4480	(19.93)	170	(77.11)
ATR 1" x 120	99-1" x length	8	5900	(26.24)	225	(102.06)
ATR 1 1/8" x 120	99-1 1/8" x length	7	7450	(33.14)	280	(127.01)
ATR 1 1/4" x 120	99-1 1/4" x length	7	9500	(42.25)	351	(159.21)
ATR 1 1/2" x 120	99-1 1/2" x length	6	13800	(61.38)	510	(231.33)

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

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P1000 - Beam Loading

Span In	Max. Allowable Uniform Load Lbs	Defl. at Uniform Load In	Uniform Loading at Deflection Span/180 Lbs	Span/240 Lbs	Span/360 Lbs
24	1,690	0.06	1,690	1,690	1,690
36	1,130	0.13	1,130	1,130	900
48	850	0.22	850	760	500
60	680	0.35	650	480	320
72	560	0.50	450	340	220
84	480	0.68	330	250	160
96	420	0.89	250	190	130
108	380	1.14	200	150	100
120	340	1.40	160	120	80
144	280	2.00	110	80	60
168	240	2.72	80	60	40
192	210	3.55	60	50	NR
216	190	4.58	50	40	NR
240	170	5.62	40	NR	NR

P1001 - Beam Loading

Span In	Max. Allowable Uniform Load Lbs	Defl. at Uniform Load In	Uniform Loading at Deflection Span/180 Lbs	Span/240 Lbs	Span/360 Lbs
24	3,500*	0.02	3,500*	3,500*	3,500*
36	3,190	0.07	3,190	3,190	3,190
48	2,390	0.13	2,390	2,390	2,390
60	1,910	0.20	1,910	1,910	1,620
72	1,600	0.28	1,600	1,600	1,130
84	1,370	0.39	1,370	1,240	830
96	1,200	0.51	1,200	950	630
108	1,060	0.64	1,000	750	500
120	960	0.79	810	610	410
144	800	1.14	560	420	280
168	680	1.53	410	310	210
192	600	2.02	320	240	160
216	530	2.54	250	190	130
240	480	3.16	200	150	100

P1000 - Column Loading

Unbraced Height In	Max. Allowable Load at Slot Face Lbs	Maximum Column Load Applied at C.G. K = 0.65 Lbs	K = 0.80 Lbs	K =1.0 Lbs	K = 1.2 Lbs
24	3,550	10,740	9,890	8,770	7,740
36	3,190	8,910	7,740	6,390	5,310
48	2,770	7,260	6,010	4,690	3,800
60	2,380	5,910	4,690	3,630	2,960
72	2,080	4,840	3,800	2,960	2,400
84	1,860	4,040	3,200	2,480	1,980
96	1,670	3,480	2,750	2,110	1,660
108	1,510	3,050	2,400	1,810	**
120	1,380	2,700	2,110	**	**
144	1,150	2,180	1,660	**	**

P1001 - Column Loading

Unbraced Height In	Max. Allowable Load at Slot Face Lbs	Maximum Column Load Applied at C.G. K = 0.65 Lbs	K = 0.80 Lbs	K =1.0 Lbs	K = 1.2 Lbs
24	6,430	24,280	23,610	22,700	21,820
36	6,290	22,810	21,820	20,650	19,670
48	6,160	21,410	20,300	18,670	16,160
60	6,000	20,210	18,670	15,520	12,390
72	5,620	18,970	16,160	12,390	8,950
84	5,170	16,950	13,630	9,470	6,580
96	4,690	14,890	11,190	7,250	5,040
108	4,170	12,850	8,950	5,730	3,980
120	3,690	10,900	7,250	4,640	**
144	2,930	7,630	5,040	**	**

P1000/P1001 - Elements of Section

Parameter	P1000		P1001	
Area of Section	0.555	in^2	1.111	in^2
Axis 1-1				
Moment of Inertia (I)	0.185	in^4	0.928	in^4
Section Modulus (S)	0.202	in^3	0.571	in^3
Radius of Gyration (r)	0.577	In	0.914	In
Axis 2-2				
Moment of Inertia (I)	0.236	in^4	0.471	in^4
Section Modulus (S)	0.290	in^3	0.580	in^3
Radius of Gyration (r)	0.651	In	0.651	In

Notes:

* Load limited by spot weld shear.

** KL/r > 200

NR = Not Recommended.

1. Beam loads are given in *total* uniform load (W Lbs) not uniform load (w lbs/ft or w lbs/in).
2. Beam loads are based on a simple span and assumed to be adequately laterally braced. Unbraced spans can reduce beam load carrying capacity. Refer to Page 62 for reduction factors for unbraced lengths.
3. For pierced channel, multiply beam loads by the following factor:

"KO" Series.....95% **"T" Series 85%**
"HS" Series .....90% **"SL" Series.....85%**
"H3" Series.....90% **"DS" Series.....70%**
"WT" Series.....85%

4. Deduct channel weight from the beam loads.
5. For concentrated midspan point loads, multiply beam loads by 50% and the corresponding deflection by 80%. For other load conditions refer to page 18.
6. All beam loads are for bending about Axis 1-1.

B-21-0421

City of Puyallup
Development & Permitting Services
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P1000 BRACE DESIGN LOAD

Unsupported Length	Compression Load*	
in (mm)	*lbs*	*(KN)*
24 (610)	4,200	18.50
36 (914)	3,650	16.00
48 (1219)	3,130	13.50
60 (1524)	2,650	11.50
72 (1829)	2,230	9.50
84 (2134)	1,850	8.00
96 (2438)	1,570	6.50
108 (2743)	1,360	6.00
120 (3048)	1,200	5.00

*Note: 1. Maximum axial load under seismic loading conditions.
2. The design load shall not exceed the allowable loads for connection detail.

SPF 400 DESIGN LOAD

* A Trademark of Lord & Sons, Inc.

Wire Rope Diameter in (mm)	4 Way Splayed				Single Cable	
	Transverse Load		Longitudinal Load		Transverse Load	
	lbs	*(kN)*	*lbs*	*(kN)*	*(lbs)*	*(kN)*
3/16 (5)	1050	4.67	1116	4.96	650	2.89

Note: 1. Allowable loads have been determined by the manufacturer's testing, analysis, and technical specifications.
2. Galvanized Wire Rope, 7 x 19 IWSC, RHRL (PRESTRETCHED)
3. Maximum torque on nut: 50 ft-lbs.
4. Safety Factor of 3 for prestretched cable.

A P P R O V E D
Fixed Equipment Anchorage
Office of Statewide Health Planning and Development
OPA-0120 Apr 25, 2003
**** Valid for 3 Years Maximum ****
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DATE: 04/25/2003

B-21-0421