



December 5, 2022

Tyler Riggs
Senior Operations Manager
RedDot Corporation
Tukwila, WA 98188

Re: Facility Relocation Sprinkler Evaluation
Puyallup Corporate Park
2504 East Main
Puyallup, WA 98372

The scope of this project was for Veltre Engineering to evaluate as a tenant improvement the ability of the existing sprinkler system at RedDot Corporation's new facility to provide an acceptable discharge to protect their current operations. The evaluation includes the impact of the new racking system on the sprinkler performance. The existing facility at 495 Andover Parks East, Tukwila, WA was visited on November 15, 2022, to identify activities, storage arrangements, and commodity classifications. Additionally, the new facility at 2504 East Main Avenue, Puyallup, WA was visited to verify that the primary components of the system that will impact the hydraulic capacity (pump data and size of mains and branch lines) was installed in accordance with the as-built drawings dated 2/9/2022. This evaluation assumes the installation has been accepted by the authority having jurisdiction (AHJ) for Puyallup as a warehouse to be leased based on the design criteria stated in the as-built drawings. The criteria applied in this evaluation is the Washington Building Code (2018 IBC and IFC with WA amendments) and NFPA 13: Standard for the Installation of Sprinkler Systems, 2016 edition.

Existing Tukwila Facility

The existing facility is a nonseparated mixed occupancy consisting of:

- Business Group B
- Factory Group F-1
- Storage Group S-1

The evaluation focused on the Storage and Factory uses since they are in the same open area. The Factory use consists of the fabrication of metal components and the assembly and testing of mobile HVAC units. The fabrication involves hydraulic presses reported to use standard combustible hydraulic fluid. The assembly is performed at workstations with 6 ft high shelf assemblies with containers of exposed unexpanded Group A plastic. The testing is conducted within compartments that are sprinklered. There are no flammable or combustible liquids. There is a small quantity of compressed gas cylinders of nitrogen and nitrogen/hydrogen (5%) that are not part of this evaluation. The sprinkler hazard classifications for the Factory use are:

- Ordinary Hazard Group 1 (typical activities)
- Ordinary Hazard Group 2 (plastic stockpiles up to 8 ft)
- Extra Hazard Group 1 (hydraulic use area)



The Storage arrangement consists of a small amount of shelf storage up to 6 ft high (see picture 1), solid pile up to 12 ft, small amount of single row racks, and mostly double row racks. The overwhelming majority of the assemblies are palletized, open racks (aka flues between the pallet loads). Some of the transverse and longitudinal flues are obstructed (see picture 2). Some of the racks have tiers of open wire mesh/decking storing individual boxes. These are solidly stacked between rack uprights with no flues (See pictures 3 and 4). Many of the racks have well maintained flues (see picture 5). There are some open top containers located at the bottom of the rack (see pictures 3 and 6).

On the racks, the overwhelming majority commodity classification is cartoned unexpanded Group A plastics. There is a very limited exposed, unexpanded Group A plastic. There is also a segregated small portion that is cartoned expanded Group A plastic (gaskets). Many of the cartons are encapsulated (see pictures 7 and 8).

In the solid pile area, there are a variety of separate commodities consisting of:

- Wood pallets, up to 8 ft (see picture 9)
- Wood open shipping frames, up to 8 ft
- (Shipping containers) exposed unexpanded Group A plastic, up to 11 ft (see pictures 10 and 11)
- (Bags of ABS resin beads) exposed unexpanded Group A plastic, small bags up to 12 ft and large 4'x4'x4' bags up to 9 ft (see pictures 12 and 13)
- (Rolls of bubble wrap) exposed expanded Group A plastic, up to 8 ft

In shipping, expanded foam (dunnage) is used in packing the product. It constitutes no more than 25% of the load volume. This is classified as cartoned unexpanded since it is less than 40% of the volume (see NFPA 13, paragraph 5.6.4.1.1.1(1)).

New Puyallup Facility

The new facility has a floor plan of 199,225 sf, a maximum ceiling height of 38'4", and a ceiling slope less than 2 in 12. The ceiling consists of plywood with 2x6 joists on 2 ft center classified as combustible obstructed combustion (see picture 14). The wood joists are supported by 2 ft and 3 ft metal trusses with steel columns (without fireproofing) throughout the floor area (see picture 15). The same occupancies groups and functions will apply.

The new racking system (as shown on the Raymond West shop drawings) will consist of double wide (labelled Type A) and single wide (labelled Type A-1) (both up to 30 ft storage height), single wide (labelled Type B) up to 24 ft storage height, and double wide cantilevered (labelled Type C) up to 14 ft storage height. The cantilever racks will store only Class 1 commodities. The aisle width is approximately 11 ft.

The solid pile storage will be dispersed throughout the facility with the same storage heights as described in the existing facility.

Automatic Sprinkler Protection

The new ceiling only (no in-rack sprinklers) sprinkler systems consist of five early suppression fast response (ESFR) sprinkler system risers on a single manifold supplied by a fire pump. The



pump/sprinkler riser room has direct access from the exterior. It is in the southeast portion of the building. The connection to the city water supply is directly north of the facility on East Main Avenue. The city water main has a 12" diameter. The private service main on the facility lot is a looped 12" diameter main with two connections to the street main. The available water supply from the as-built drawings at East Main Avenue is Static = 55 psi and Residual = 45 psi at 1,182 gpm.

The electric driven fire pump is on from Patterson. The pump data, as identified on the name plate (see picture 16), is: Static pressure = 116 psi, rating = 1,500 gpm at 105 psi, and 88 psi at 2,250 gpm (150% of rating).

All ESFR systems use pendent K-16.8 sprinklers with a minimum pressure of 52 psi. The as-built drawings accurately state the system can protect:

- Palletized and solid pile storage up to 35 ft
 - Class I-IV, cartoned and exposed nonexpanded Group A plastic
- Rack Storage up to 35 ft
 - Class I-IV, cartoned and exposed nonexpanded Group A plastic
- Idle wood or plastic pallets up to 35 ft

It does not mention either exposed expanded or cartoned expanded Group A plastics.

Based on the hydraulic data sign, the typical system demand at the base of the riser (without hose demand is 1,459 gpm at 115 psi (see picture 17). The associated hydraulic calculations were not available with the as-builts drawings.

Evaluation

Ceiling Construction

The ceiling is combustibile obstructed construction. NFPA 13, 2016 edition does not allow ESFR sprinkler with this type of construction (see NFPA 13, paragraph 8.4.6.3 and Table 8.12.2.2.1). This restriction was unnecessarily conservative and was deleted in the 2019 edition (see NFPA 13, paragraph 14.2.4). Note the Table was not corrected until the 2022 edition. Veltre Engineering considers the use of ESFR sprinklers to be acceptable.

Storage Piles

The pile sizes are required to have a maximum size of 60 ft x 60 ft and 3,600 sf (see IFC Table 3206.2). Piles are to be separated by aisles that comply with NFPA 13 (see IFC 3206.10). The only aisle size defined by NFPA 13 is a minimum 4 ft aisle for defining separation of racks and 4 ft and 8 ft for defining discharge criteria for spray sprinklers. ESFR sprinkler criteria is not affected by aisle width. The goal of separating the pile size is to reduce the potential fire spread. Veltre Engineering considers with ESFR sprinkler protection that a 4 ft aisle is adequate for separating storage piles.

Rack Flues

ESFR sprinkler system require the racks to qualify as an open rack. NFPA 13 and IFC paragraph 3208.2.2 defines this as individual loads within the rack covering no more than 20 sf with boundaries defined by



flues and/or aisles on all sides. NFPA 13 has some exceptions for storage heights up to 25 ft whereby longitudinal flues (those running parallel to the aisle) are not required but transverse flues (perpendicular to the aisle) must be provided at the rack upright frame members and between the load with a maximum spacing of 5 ft. IFC paragraph 3208.3 (on flues) has different criteria and supersedes NFPA 13. It also provides exceptions to IFC paragraph 3208.2.2 on the 20-sf load. IFC Table 3208.3 – *Required Flue Spaces for Rack Storage* has criteria for storage heights up to 25 ft and greater than 25 ft that is:

Single Row Rack (both up to 25 ft and greater)

Transverse flues: 3 in every 5 ft

Double Row Rack

Up to 25 ft

Transvers flues: 3 in every 10 ft

Longitudinal flues: not required

Greater than 25 ft

Transvers flues: 3 in every 5 ft

Longitudinal flues: 6 in

There are two main differences on flues between NFPA 13 and IFC. One is the minimum flue size (width) with NFPA 13 requiring all to be 6 in and IFC reducing the transverse flues to 3 in. The other is the maximum spacing between transverse flues with NFPA 13 requiring them to be at the rack uprights and between the load with a maximum spacing of 5 ft. If a large load exceeds the maximum spacing, then the rack is classified as having solid shelving and in-rack sprinklers are required. IFC does not define the spacing (defaulting to NFPA 13) except for the single case of double row racks with storage up to 25 ft and when ESFR sprinklers are used. This is accomplished by a note a to IFC Table 3208.3 applicable only to double row racks. It is worth noting that single row racks present a less demanding fire scenario than single row rack, but the IFC did not apply this allowance to them. It is appropriate to extend the 10 ft spacing to single row since they are less demanding than a double row rack, but since it is not explicitly stated in the IFC, it would require the approval of the AHJ.

Column Protection

When building columns are not provided with fireproofing and located within the footprint of racks for storage heights greater than 15 ft, they are typically required to be protected. There are a couple of exceptions to this requirement one of which is the use of ESFR sprinklers (see NFPA 13 paragraph 17.1.4.1(4)). As such, column protection is not required.

Water Supply

The water supply identified on the as-built drawings (Static = 55 psi and Residual = 45 psi at 1,182 gpm) were somewhat substantiated by the Puyallup Water Dept (email from Brian Johnson dated



11/15/2022). They identified that the static pressure in the area is approximately 53 psi but could not provide the residual pressure except for the fire flow (at 20 psi) is equal to or greater than 1950 gpm which is the highest flow category. The fire flow based on the as-built water supply data is 2,522 gpm. It was also confirmed that the water supply is “pretty consistent” year-round so there is no need to apply a seasonal modifier.

Hydraulic Calculations

There were no hydraulic calculations submitted with the as-built drawings. The hydraulic data signs indicates a typical demand at the base of the riser to be 1,459 gpm at 115 psi. Veltre Engineering performed a supplemental hydraulic calculation and found the demand at the base of the riser to be 1,468 gpm at 117 psi (see Appendix B).

Adequacy of Protection

The F-1 portion of the facility can be protected with ESFR sprinklers. The 2016 edition of NFPA 13 identifies that ESFR sprinkler designed for any storage criteria can protected Light and Ordinary Hazard occupancies (see NFPA 13, paragraph 8.4.6.6). This allowance was further clarified in the 2019 edition of NFPA 13 where it includes “Any storage arrangement OH1, OH2, EH1, and EH2 design criteria”. The standard Extra Hazard occupancies are not included due to the inability for ESFR sprinklers to address significantly shielded fires. The hydraulic use area does not present a shielded fire and Veltre Engineering considers the use of ESFR sprinkler for this small Extra Hazard Group 1 occupancy acceptable.

The S-1 portion of the facility for ceiling height, storage arrangements, and commodities can be protected with ESFR sprinklers except for areas with exposed and/or cartoned expanded Group A plastics. The ESFR criteria is:

Exposed Expanded Group A

Storage up to 25

ESFR K-25.2 @ 30 psi for 30 ft ceiling or 60 psi for 40 ft ceiling

Cartoned Expanded Group A

Storage up to 25

ESFR K-16.8 @ 35 psi for 30 ft ceiling or 42 psi for 32 ft ceiling

There is no criterion for exposed expanded Group A plastic using K-16.8 ESFR sprinklers. There is no criterion for cartoned expanded Group A plastic using ESFR sprinklers for 38 ft ceilings.

Conclusion

The conclusions for the fire protection review of the ESFR sprinkler system in the new facility are:

Ceiling Construction

No action required.

Storage Piles

RedDot needs to implement control of pile size and maintain clear aisle space around them.

Rack Flues

RedDot needs to implement an awareness on providing flues where shelves are hand packed with individual cartons and long loads such as 4x8 sheets of steel as well as maintaining flues for palletized loads.

Column Protection

No action required.

Water Supply

No action required.

Hydraulic Calculations

No action required.

Adequacy of Protection

F-1 portion:

No action required

S-1 portion:

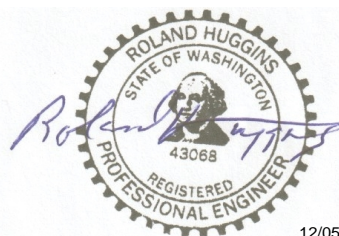
The sprinkler system is not adequate for the areas storing expanded Group A plastics. RedDot needs to modify the facility or identify an alternate protection scheme for these areas.

The options to correct this deficiency, after segregating the expanded Group A plastics into separate areas, are one of the following:

- Reduce storage height to no more than 5 ft.
- Reduce the ceiling height to no more than 32 ft for that area (such as a canopy), storage no more than 25 ft, and install ESFR K-16.8 sprinklers at 42 psi. Have either a draft curtain at the outer edge or a row of sprinklers between the face of the storage rack and the outer edge.
- Retain ESFR sprinklers at the ceiling but apply the Alternate Approach in NFPA 13: section 17.1.2.9 whereby in-rack sprinklers combined with horizontal barriers are installed within the racks
- Investigate if these products can be stored within a CARDEX protected per FM Data Sheet 8-34 instead of Data Sheet 8-9



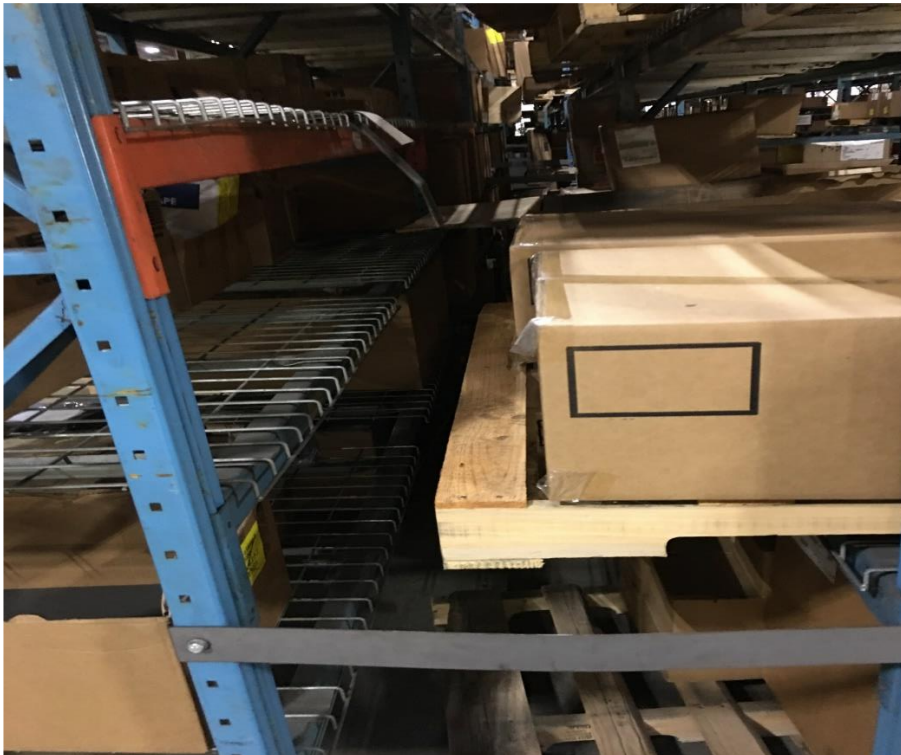
Roland Huggins, PE
Veltre Engineering, Inc
(253) 358-8801



Appendix A - Pictures Existing & New Facility



Picture 1 – Shelf Storage



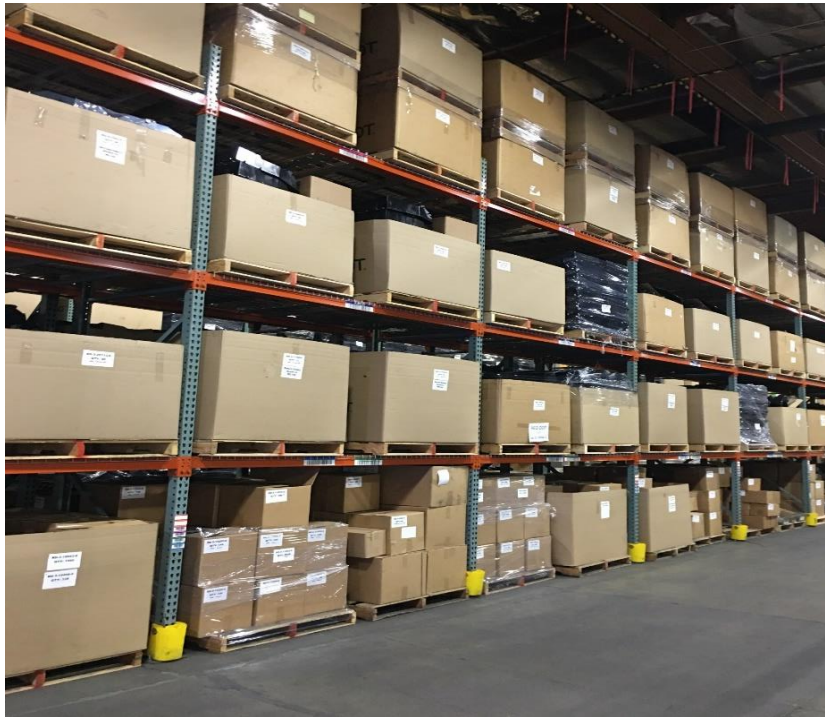
Picture 2 – Flue in Rack



Picture 3 – No Flues with Box Loads



Picture 4 – Flue with Pallet Load



Picture 5 – Maintained Flues



Picture 6 – Open Top Container



Picture 7 – Encapsulated Load



Picture 8 – Encapsulated in Rack



Picture 9 – Pallets Stored Inside



Picture 10 – Shipping Container in Rack



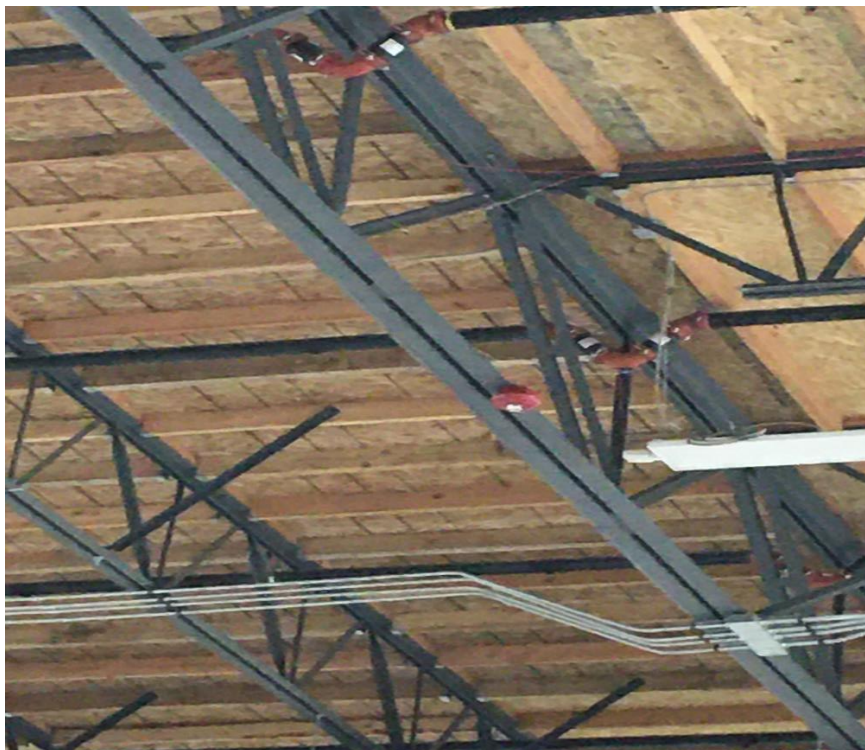
Picture 11 – Shipping Containers



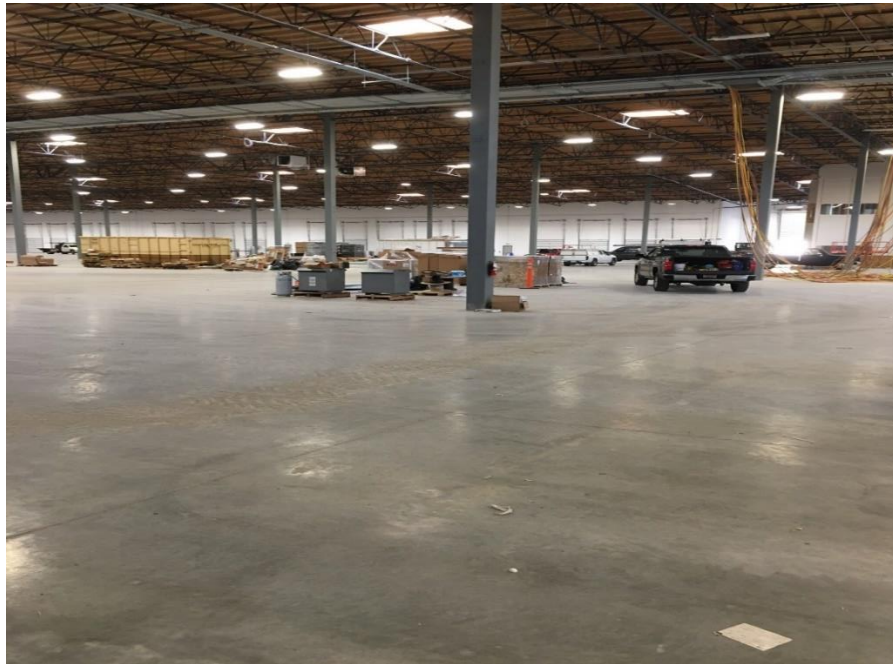
Picture 12 – Resin Beads, Small Bags



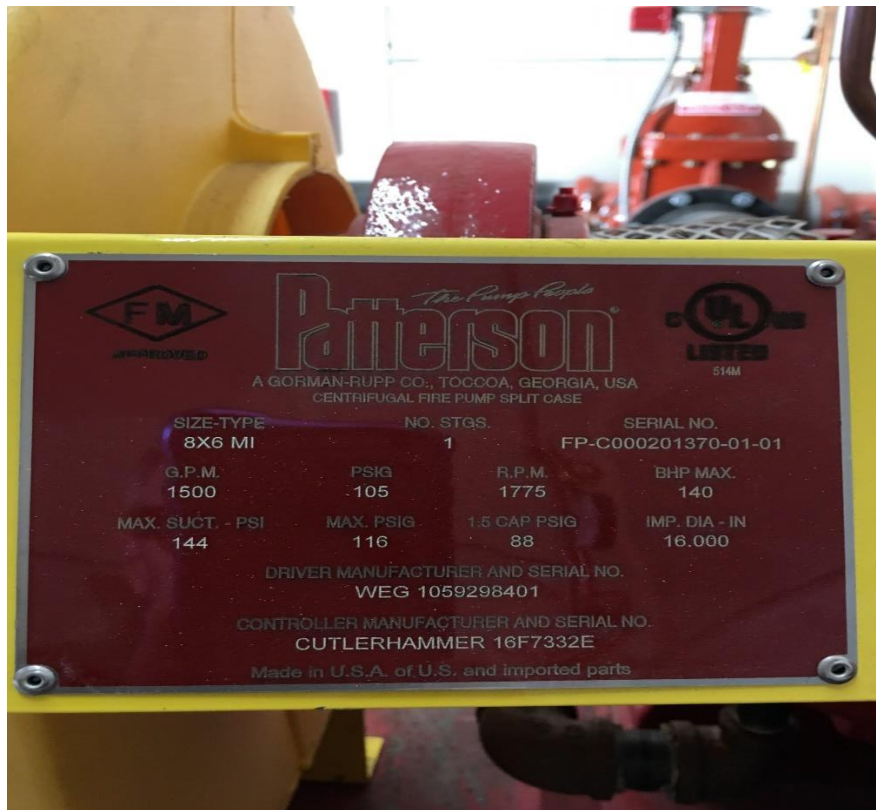
Picture 13 – Resin Beads, Large Bags



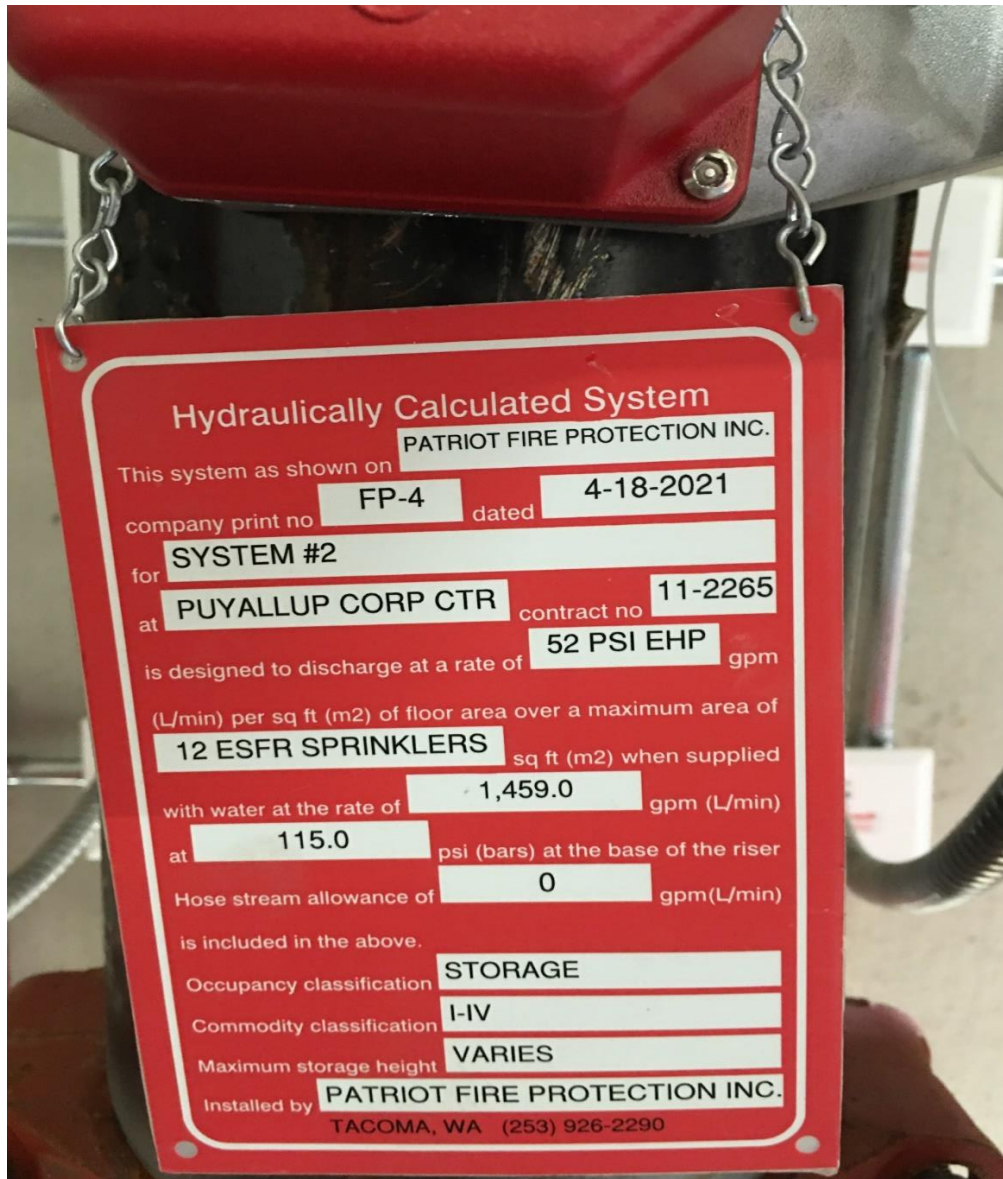
Picture 14 – Combustible Obstructed Ceiling



Picture 15 – Columns



Picture 16 – Pump Data Plate



Picture 17 – Hydraulic Data Sign

Appendix B – Hydraulic Calculation



Hydraulic Calculations by HydraCALC

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300 DESCHUTES WAY SW
SUITE 210
TUMWATER, WA, 98512

Job Name : PUYALLUP LOGISTICS CENTER
Drawing :
Location :
Remote Area :
Contract :
Data File : R21-FP PUYALLUP LOGISTICS CENTER-UPDATED Area 1.WXF

Water Supply Curve

City Water Supply:

C1 - Static Pressure : 55
C2 - Residual Pressure: 45
C2 - Residual Flow : 1182

**City Water Adjusted to Pump Inlet
for Pf - Elev - Hose Flow**

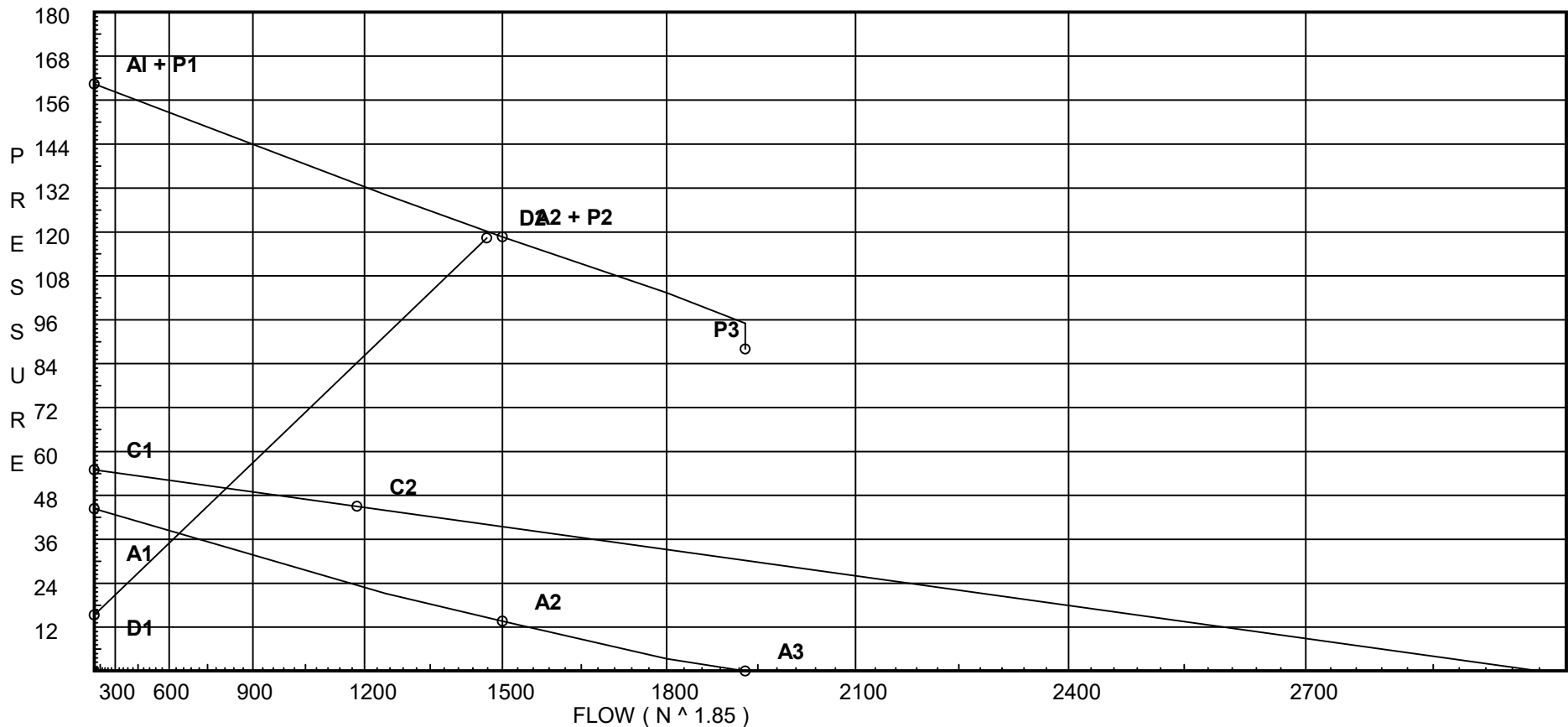
A1 - Adjusted Static: 44.375
A2 - Adj Resid : 13.648 @ 1500
A3 - Adj Resid : 0 @ 1930

Pump Data:

P1 - Pump Churn Pressure : 116
P2 - Pump Rated Pressure : 105
P2 - Pump Rated Flow : 1500
P3 - Pump Pressure @ Max Flow : 88
P3 - Pump Max Flow : 1930.00
City Residual Flow @ 0 = 2970.39
City Residual Flow @ 20 = 2326.53
City Water @ 150% of Pump = 30.23
Pump flow terminated at adjusted curve 0 psi

Demand:

D1 - Elevation : 15.293
D2 - System Flow : 1467.96
D2 - System Pressure : 118.367
Hose (Demand) : _____
D3 - System Demand : 1467.96
Hose (Adj City) : 500
Safety Margin : 1.846



Fittings Used Summary

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121

Units Summary

Diameter Units	Inches
Length Units	Feet
Flow Units	US Gallons per Minute
Pressure Units	Pounds per Square Inch

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

SUPPLY ANALYSIS

Node at Source	Static Pressure	Residual Pressure	Flow	Available Pressure	Total Demand	Required Pressure
PO	See Information on Pump Curve			120.213	1467.96	118.367
SRS	55.0	45	1182.0	29.32	1967.96	29.32

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
100	31.31	16.8	52.0	121.15	0.1215 100
101	31.31	16.8	52.12	121.28	0.1215 100
102	31.31		53.42		
103	28.5		55.33		
104	28.5		55.96		
105	28.5		56.14		
106	32.94		55.76		
107	32.94		95.22		
108	28.5		98.69		
TOR	26.0		104.84		
BOR	1.77		117.14	← Base of Riser	
PO	1.77		118.37		
PI	1.77		14.67		
UG	1.97		15.49		
U1	-4.0		28.19	500.0	
U2	-4.0		29.0		
U3	-4.0		29.21		
SRS	-4.0		29.32		
109	29.67	16.8	52.38	121.59	0.1215 100
110	29.67	16.8	52.5	121.72	0.1215 100
111	29.67		53.81		
112	28.5		54.96		
113	28.5		55.04		
114	30.49	16.8	52.09	121.25	0.1215 100
115	30.49	16.8	52.2	121.39	0.1215 100
116	30.49		53.52		
117	29.67	16.8	53.92	123.37	0.1215 100
118	29.67	16.8	54.22	123.7	0.1215 100
119	29.67		94.0		
120	28.5		95.19		
121	28.5		96.19		
122	29.67		97.64		
123	28.5		98.42		
124	28.5		98.44		
125	28.5		98.46		
126	28.5		98.51		
127	28.5		98.58		
128	30.49	16.8	53.62	123.02	0.1215 100
129	30.49	16.8	53.91	123.35	0.1215 100
130	30.49		93.28		
131	28.5		94.74		

NODE ANALYSIS (cont.)

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes	
132	31.31	16.8	53.53	122.91	0.1215	100
133	31.31	16.8	53.81	123.24	0.1215	100
134	31.31		92.84			
135	31.31		96.51			
136	30.49		96.87			
137	29.67		97.28			
138	28.5		96.69			
139	29.67		97.7			
140	28.5		98.42			
141	28.5		97.92			
142	29.67		97.84			
143	28.5		98.42			
144	28.5		98.0			
145	29.67		97.85			
146	28.5		98.42			
147	29.67		97.85			
148	28.5		98.42			
U4	-4.0		28.99			
U5	-4.0		29.21			
149	32.12		55.9			
150	32.12		95.51			

Final Calculations : Hazen-Williams

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PUYALLUP LOGISTICS CENTER

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
100 to 101	31.31 31.31	16.80	121.15	3			9.000	120	52.000 0.0			
			121.15	3.334			9.000	0.0131	0.118	Vel =	4.45	
101 to 102	31.31 31.31	16.80	121.28	3	T	22.488	5.260 22.488 27.748	120	52.118 0.0			
			242.43	3.334			27.748	0.0471	1.307	Vel =	8.91	
102 to 103	31.31 28.5		-61.78	3	T	22.488	2.810 22.488 25.298	120	53.425 1.217			
			180.65	3.334			25.298	0.0274	0.692	Vel =	6.64	
103 to 104	28.5 28.5		358.82	4			10.000	120	55.334 0.0			
			539.47	4.26			10.000	0.0628	0.628	Vel =	12.14	
104 to 105	28.5 28.5		-270.00	4			10.000	120	55.962 0.0			
			269.47	4.26			10.000	0.0173	0.173	Vel =	6.07	
105 to 106	28.5 32.94		0.0	3	T	22.488	4.440 22.488 26.928	120	56.135 -1.923			
			269.47	3.334			26.928	0.0573	1.544	Vel =	9.90	
106 to 107	32.94 32.94		0.0	3	2T 3E	44.976 31.483	612.120 76.459 688.579	120	55.756 0.0			
			269.47	3.334			688.579	0.0573	39.464	Vel =	9.90	
107 to 108	32.94 28.5		0.0	3	T	22.488	4.440 22.488 26.928	120	95.220 1.923			
			269.47	3.334			26.928	0.0573	1.543	Vel =	9.90	
108 to TOR	28.5 26		1198.49	8	6E	126.847	190.030 126.847 316.877	120	98.686 1.083			
			1467.96	8.249			316.877	0.0160	5.070	Vel =	8.81	
TOR to BOR	26 1.77		0.0	8	T B	41.108 14.094	24.230 55.202 79.432	120	104.839 11.034		** Fixed Loss = 0.54	
			1467.96	8.249			79.432	0.0160	1.272	Vel =	8.81	
BOR to PO	1.77 1.77		0.0	8	E T	21.141 41.108	14.150 62.249 76.399	120	117.145 0.0			
			1467.96	8.249			76.399	0.0160	1.222	Vel =	8.81	
PO			0.0 1467.96						118.367		K Factor = 134.93	
System Demand Pressure									118.367			
Safety Margin									1.846			
Continuation Pressure									120.213			
Pressure @ Pump Outlet									120.213			
Pressure From Pump Curve									-105.547			
Pressure @ Pump Inlet									14.666			
PI to UG	1.77 1.97		0.0	8	2E	42.282	14.550 42.282 56.832	120	14.666 -0.087			
			1467.96	8.249			56.832	0.0160	0.910	Vel =	8.81	
UG to U1	1.97 -4		0.0	8	4E T	85.618 41.62	132.970 127.238 260.208	120	15.489 8.586		** Fixed Loss = 6	
			1467.96	8.27			260.208	0.0158	4.113	Vel =	8.77	
U1 to U2	-4 -4		-744.55	12	6E	253.171	1528.960 253.171 1782.131	140	28.188 0.0			
			723.41	12.34			1782.131	0.0005	0.814	Vel =	1.94	

Final Calculations : Hazen-Williams

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
U2 to U3	-4 -4		240.81 964.22	12 12.34	2T	187.534	81.500 187.534 269.034	140 0.0008	29.002 0.0 0.209		Vel = 2.59	
U3 to SRS	-4 -4		19.69 983.91	12 12.34			135.360 135.360	140 0.0008	29.211 0.0 0.110		Vel = 2.64	
SRS			0.0 983.91						29.321		K Factor = 181.70	
109 to 110	29.67 29.67	16.80	121.59	3 3.334			9.000 9.000	120 0.0131	52.378 0.0 0.118		Vel = 4.47	
110 to 111	29.67 29.67	16.80	121.72	3 3.334	T	22.488	5.260 22.488 27.748	120 0.0475	52.496 0.0 1.317		Vel = 8.94	
111 to 112	29.67 28.5		-64.07	3 3.334	T	22.488	1.170 22.488 23.658	120 0.0269	53.813 0.507 0.637		Vel = 6.59	
112 to 113	28.5 28.5		0.0	4 4.26			10.000 10.000	120 0.0082	54.957 0.0 0.082		Vel = 4.03	
113 to 103	28.5 28.5		179.58	4 4.26			10.000 10.000	120 0.0295	55.039 0.0 0.295		Vel = 8.08	
103			0.0 358.82						55.334		K Factor = 48.24	
114 to 115	30.49 30.49	16.80	121.25	3 3.334			9.000 9.000	120 0.0130	52.088 0.0 0.117		Vel = 4.46	
115 to 116	30.49 30.49	16.80	121.38	3 3.334	T	22.488	5.260 22.488 27.748	120 0.0472	52.205 0.0 1.310		Vel = 8.92	
116 to 113	30.49 28.5		-63.04	3 3.334	T	22.488	1.990 22.488 24.478	120 0.0270	53.515 0.862 0.662		Vel = 6.60	
113			0.0 179.59						55.039		K Factor = 24.21	
111 to 117	29.67 29.67		64.08	3 3.334	T	22.488	4.740 22.488 27.228	120 0.0040	53.813 0.0 0.109		Vel = 2.35	
117 to 118	29.67 29.67	16.80	123.36	3 3.334			10.000 10.000	120 0.0293	53.922 0.0 0.293		Vel = 6.89	
118 to 119	29.67 29.67	16.80	123.70	3 3.334			531.980 531.980	120 0.0748	54.215 0.0 39.781		Vel = 11.43	
119 to 120	29.67 28.5		-181.20	3 3.334	2T	44.976	1.170 44.976 46.146	120 0.0149	93.996 0.507 0.686		Vel = 4.78	

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
120 to 121	28.5 28.5		234.88 364.82	3 3.334			10.000 10.000	120 0.1004	95.189 0.0 1.004			Vel = 13.41
121 to 122	28.5 29.67		-250.15 114.67	3 3.334	3T 3E	67.464 31.483	66.570 98.947 165.517	120 0.0118	96.193 -0.507 1.953			Vel = 4.21
122 to 123	29.67 28.5		0.0 114.67	3 3.334	T	22.488	1.170 22.488 23.658	120 0.0118	97.639 0.507 0.279			Vel = 4.21
123 to 124	28.5 28.5		250.15 364.82	8 8.249			10.000 10.000	120 0.0012	98.425 0.0 0.012			Vel = 2.19
124 to 125	28.5 28.5		181.20 546.02	8 8.249			10.000 10.000	120 0.0026	98.437 0.0 0.026			Vel = 3.28
125 to 126	28.5 28.5		189.92 735.94	8 8.249			10.000 10.000	120 0.0044	98.463 0.0 0.044			Vel = 4.42
126 to 127	28.5 28.5		192.55 928.49	8 8.249			10.000 10.000	120 0.0069	98.507 0.0 0.069			Vel = 5.57
127 to 108	28.5 28.5		270.01 1198.5	8 8.249			10.000 10.000	120 0.0110	98.576 0.0 0.110			Vel = 7.19
108			0.0 1198.50						98.686			K Factor = 120.65
116 to 128	30.49 30.49		63.05 63.05	3 3.334	T	22.488	4.740 22.488 27.228	120 0.0039	53.515 0.0 0.106			Vel = 2.32
128 to 129	30.49 30.49	16.80	123.02 186.07	3 3.334			10.000 10.000	120 0.0289	53.621 0.0 0.289			Vel = 6.84
129 to 130	30.49 30.49	16.80	123.35 309.42	3 3.334			531.980 531.980	120 0.0740	53.910 0.0 39.375			Vel = 11.37
130 to 131	30.49 28.5		-189.93 119.49	3 3.334	2T	44.976	1.990 44.976 46.966	120 0.0127	93.285 0.862 0.597			Vel = 4.39
131 to 120	28.5 28.5		115.39 234.88	3 3.334			10.000 10.000	120 0.0445	94.744 0.0 0.445			Vel = 8.63
120			0.0 234.88						95.189			K Factor = 24.07
102 to 132	31.31 31.31		61.78 61.78	3 3.334	T	22.488	4.740 22.488 27.228	120 0.0038	53.425 0.0 0.103			Vel = 2.27
132 to 133	31.31 31.31	16.80	122.91 184.69	3 3.334			10.000 10.000	120 0.0284	53.528 0.0 0.284			Vel = 6.79

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
133 to 134	31.31 31.31	16.80	123.24 307.93	3 3.334			531.980 531.980	120 0.0734	53.812 0.0 39.026			Vel = 11.32
134 to 131	31.31 28.5		-192.55 115.38	3 3.334	2T	44.976	12.810 44.976 57.786	120 0.0119	92.838 1.217 0.689			Vel = 4.24
131			0.0 115.38						94.744			K Factor = 11.85
134 to 135	31.31 31.31		192.55 192.55	3 3.334	3E T	31.483 22.488	65.400 53.971 119.371	120 0.0308	92.838 0.0 3.674			Vel = 7.08
135 to 126	31.31 28.5		0.0 192.55	3 3.334	T	22.488	2.810 22.488 25.298	120 0.0308	96.512 1.217 0.778			Vel = 7.08
126			0.0 192.55						98.507			K Factor = 19.40
130 to 136	30.49 30.49		189.92 189.92	3 3.334	3E T	31.483 22.488	65.400 53.971 119.371	120 0.0300	93.285 0.0 3.581			Vel = 6.98
136 to 125	30.49 28.5		0.0 189.92	3 3.334	T	22.488	1.990 22.488 24.478	120 0.0300	96.866 0.862 0.735			Vel = 6.98
125			0.0 189.92						98.463			K Factor = 19.14
119 to 137	29.67 29.67		181.20 181.2	3 3.334	3E T	31.483 22.488	65.400 53.971 119.371	120 0.0275	93.996 0.0 3.284			Vel = 6.66
137 to 124	29.67 28.5		0.0 181.2	3 3.334	T	22.488	1.170 22.488 23.658	120 0.0275	97.280 0.507 0.650			Vel = 6.66
124			0.0 181.20						98.437			K Factor = 18.26
121 to 138	28.5 28.5		250.14 250.14	3 3.334			10.000 10.000	120 0.0499	96.193 0.0 0.499			Vel = 9.19
138 to 139	28.5 29.67		-150.33 99.81	3 3.334	3T 3E	67.464 31.483	66.570 98.947 165.517	120 0.0091	96.692 -0.507 1.511			Vel = 3.67
139 to 140	29.67 28.5		0.0 99.81	3 3.334	T	22.488	1.170 22.488 23.658	120 0.0091	97.696 0.507 0.216			Vel = 3.67
140 to 123	28.5 28.5		150.33 250.14	8 8.249			10.000 10.000	120 0.0006	98.419 0.0 0.006			Vel = 1.50
123			0.0 250.14						98.425			K Factor = 25.21
138 to 141	28.5 28.5		150.33 150.33	3 3.334	T E	22.488 10.494	30.000 32.982 62.982	120 0.0195	96.692 0.0 1.226			Vel = 5.52

Final Calculations : Hazen-Williams

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
141 to 142	28.5 29.67		-96.19 54.14	3 3.334	3T 3E	67.464 31.483	46.570 98.947 145.517	120 0.0029	97.918 -0.507 0.429			Vel = 1.99
142 to 143	29.67 28.5		0.0 54.14	3 3.334	T	22.488	1.170 22.488 23.658	120 0.0029	97.840 0.507 0.069			Vel = 1.99
143 to 140	28.5 28.5		96.19 150.33	8 8.249			10.000 10.000	120 0.0003	98.416 0.0 0.003			Vel = 0.90
140			0.0 150.33						98.419			K Factor = 15.15
141 to 144	28.5 28.5		96.19 96.19	3 3.334			10.000 10.000	120 0.0086	97.918 0.0 0.086			Vel = 3.53
144 to 145	28.5 29.67		-47.34 48.85	3 3.334	3T 3E	67.464 31.483	46.570 98.947 145.517	120 0.0024	98.004 -0.507 0.354			Vel = 1.80
145 to 146	29.67 28.5		0.0 48.85	3 3.334	T	22.488	1.170 22.488 23.658	120 0.0024	97.851 0.507 0.057			Vel = 1.80
146 to 143	28.5 28.5		47.34 96.19	8 8.249			10.000 10.000	120 0.0001	98.415 0.0 0.001			Vel = 0.58
143			0.0 96.19						98.416			K Factor = 9.70
144 to 147	28.5 29.67		47.34 47.34	3 3.334	3T 3E	67.464 31.483	56.570 98.947 155.517	120 0.0023	98.004 -0.507 0.357			Vel = 1.74
147 to 148	29.67 28.5		0.0 47.34	3 3.334	T	22.488	1.170 22.488 23.658	120 0.0023	97.854 0.507 0.054			Vel = 1.74
148 to 146	28.5 28.5		0.0 47.34	8 8.249			10.000 10.000	120 0	98.415 0.0 0.0			Vel = 0.28
146			0.0 47.34						98.415			K Factor = 4.77
U1 to U4	-4 -4	H500	1244.56 1244.56	12 12.34	3E	126.586	513.610 126.586 640.196	140 0.0012	28.188 0.0 0.798			Vel = 3.34
U4 to U5	-4 -4		-240.82 1003.74	12 12.34	2T	187.534	81.500 187.534 269.034	140 0.0008	28.986 0.0 0.225			Vel = 2.69
U5 to SRS	-4 -4		-19.69 984.05	12 12.34			135.360 135.360	140 0.0008	29.211 0.0 0.110			Vel = 2.64
SRS			0.0 984.05						29.321			K Factor = 181.73

Final Calculations : Hazen-Williams

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqiv	Len	Pipe Ftngs Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
U4 to U2	-4 -4		240.81 240.81	12 12.34			270.720 270.720	140 0.0001	28.986 0.0 0.016		Vel = 0.65	
U2			0.0 240.81						29.002		K Factor = 44.72	
U5 to U3	-4 -4		19.69 19.69	12 12.34			49.620 49.620	140 0	29.211 0.0 0.0		Vel = 0.05	
U3			0.0 19.69						29.211		K Factor = 3.64	
104 to 149	28.5 32.12		270.01 270.01	3 3.334	T	22.488	3.620 22.488 26.108	120 0.0575	55.962 -1.568 1.502		Vel = 9.92	
149 to 150	32.12 32.12		0.0 270.01	3 3.334	2T 3E	44.976 31.483	612.120 76.459 688.579	120 0.0575	55.896 0.0 39.610		Vel = 9.92	
150 to 127	32.12 28.5		0.0 270.01	3 3.334	T	22.488	3.620 22.488 26.108	120 0.0575	95.506 1.568 1.502		Vel = 9.92	
127			0.0 270.01						98.576		K Factor = 27.20	

December 05, 2022

Tyler Riggs
 Senior Operations Manager
 RedDot Corporation
 Tukwila, WA 98188
 Mr. Riggs

This is a supplemental report to Veltre Engineering’s evaluation on the ability of the existing sprinkler system at RedDot Corporation’s new facility to provide an acceptable discharge to protect their current operations. This report addresses issues that do not impact the ability of the sprinkler system to protect the contents, but that RedDot should address.

RedDot currently stores a significant amount of outside material close to the building (see pictures 1 and 2). These combustibles need to be adequately separated from the building (by either distance or a fire rated barrier) or the exterior wall protected (by either fire rated construction or a water spray system).

The sprinkler as-built drawings have identified that the sprinklers immediately adjacent to the ceiling unit heaters have an intermediate temperature rating (see Figure A) as required by NFPA 13, paragraph 9.4.2.5. The requirement for intermediate rated sprinklers extends 20 ft out discharge side of the unit

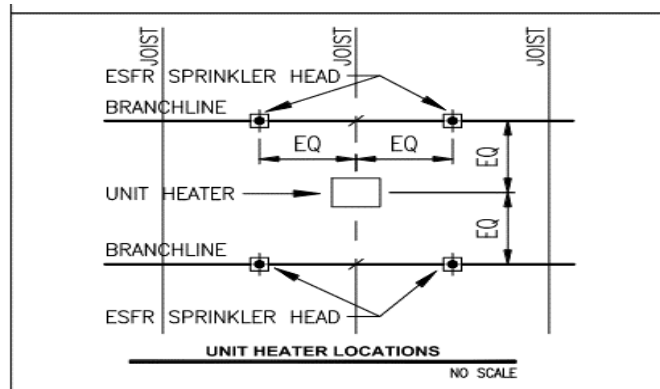


Figure A – Temperature Ratings Near Unit Heaters

heater in a pie shape area based on a 30-degree angle out from the corner of the unit heater. This would pick-up two to four sprinklers on the next branch line. The second branch line is note addressed on the as-builts. The installing contractor should verify the temperature rating complies with NFPA 13 and update the as-built drawings to reflect it. If sprinklers with an ordinary temperature rating have been installed on the second branch line, the heater discharge could inadvertently activate the sprinklers.

Roland Huggins, PE
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Appendix: Pictures Existing Facility



Picture 1 – Exterior Combustibles



Picture 2 – Exterior Combustibles