VE VELTRE ENGINEERING, INC.
FIRE PROTECTION | LIFE SAFETY
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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)

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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

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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 combustible 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

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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 that 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

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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.

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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

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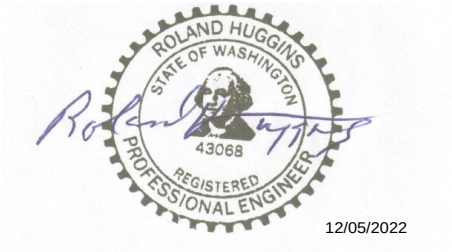

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Appendix A - Pictures Existing & New Facility

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Picture 1 – Shelf Storage

Picture 2 – Flue in Rack

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Picture 3 – No Flues with Box Loads

Picture 4 – Flue with Pallet Load

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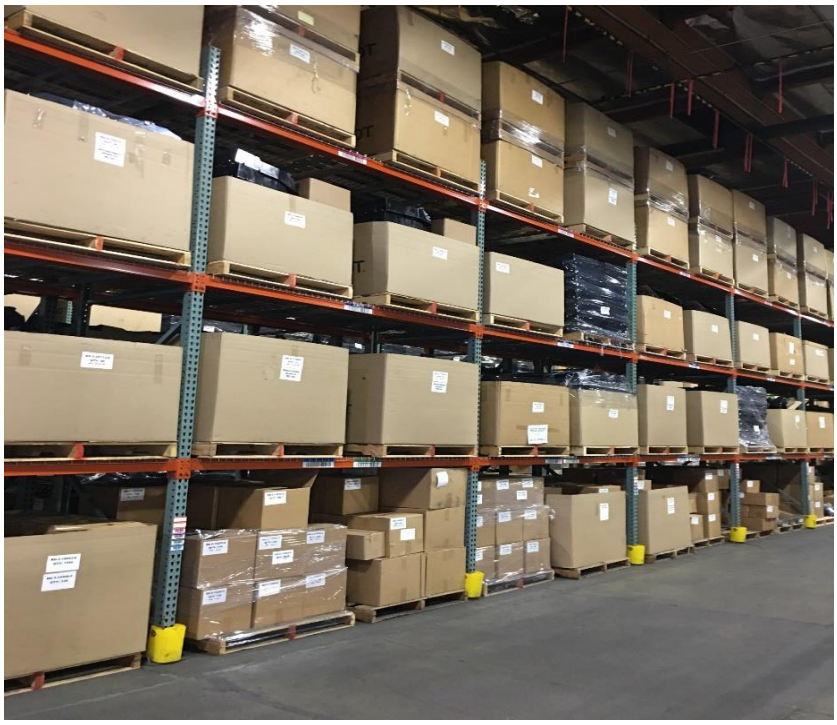

Picture 5 – Maintained Flues

Picture 6 – Open Top Container

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Picture 7 – Encapsulated Load

Picture 8 – Encapsulated in Rack

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Picture 9 – Pallets Stored Inside

Picture 10 – Shipping Container in Rack

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Picture 11 – Shipping Containers

Picture 12 – Resin Beads, Small Bags

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Picture 13 – Resin Beads, Large Bags

Picture 14 – Combustible Obstructed Ceiling

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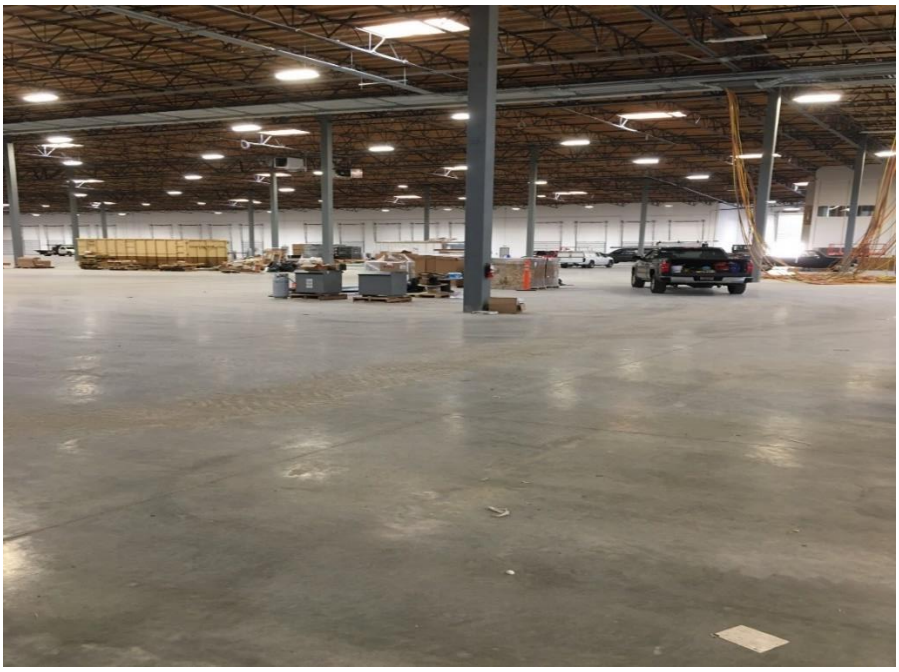
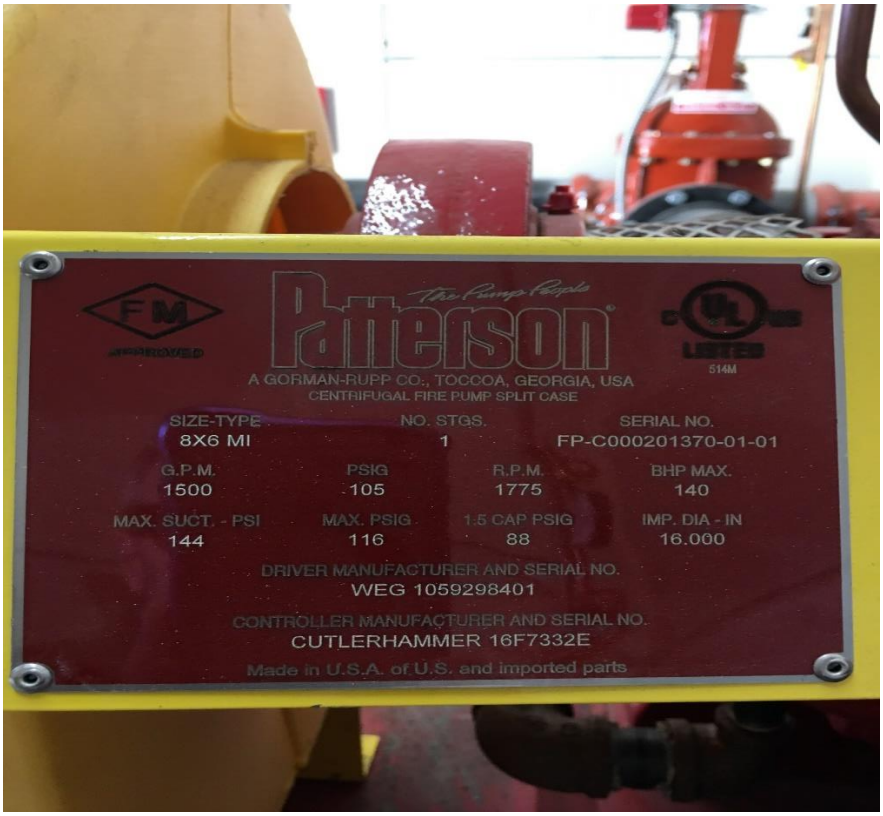


Picture 15 – Columns



Picture 16 – Pump Data Plate

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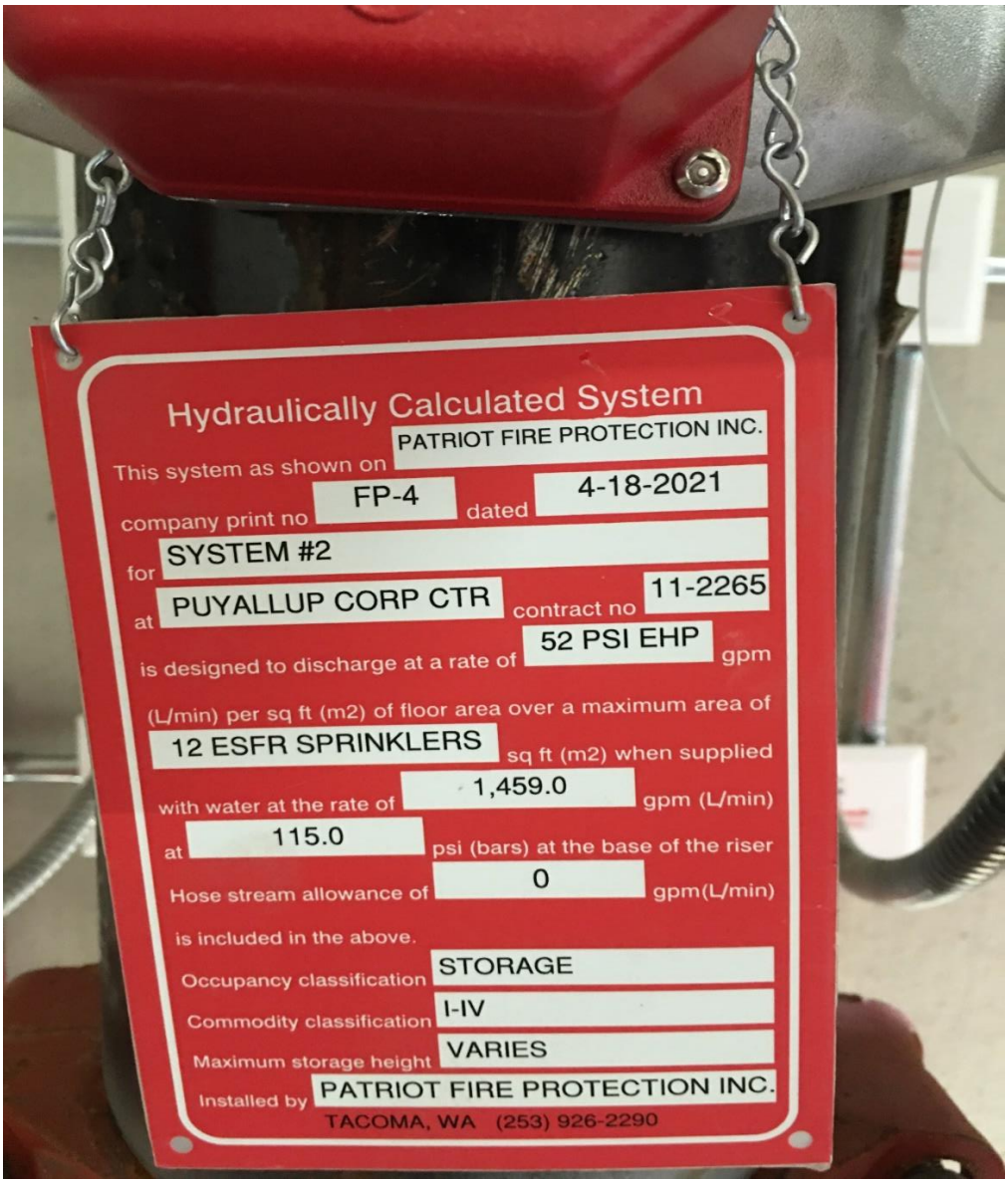

Picture 17 – Hydraulic Data Sign

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Appendix B – Hydraulic Calculation

Hydraulic Calculations by HydraCALC

VELTRE ENGINEERING
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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

VELTRE ENGINEERING
PUYALLUP LOGISTICS CENTER

Date

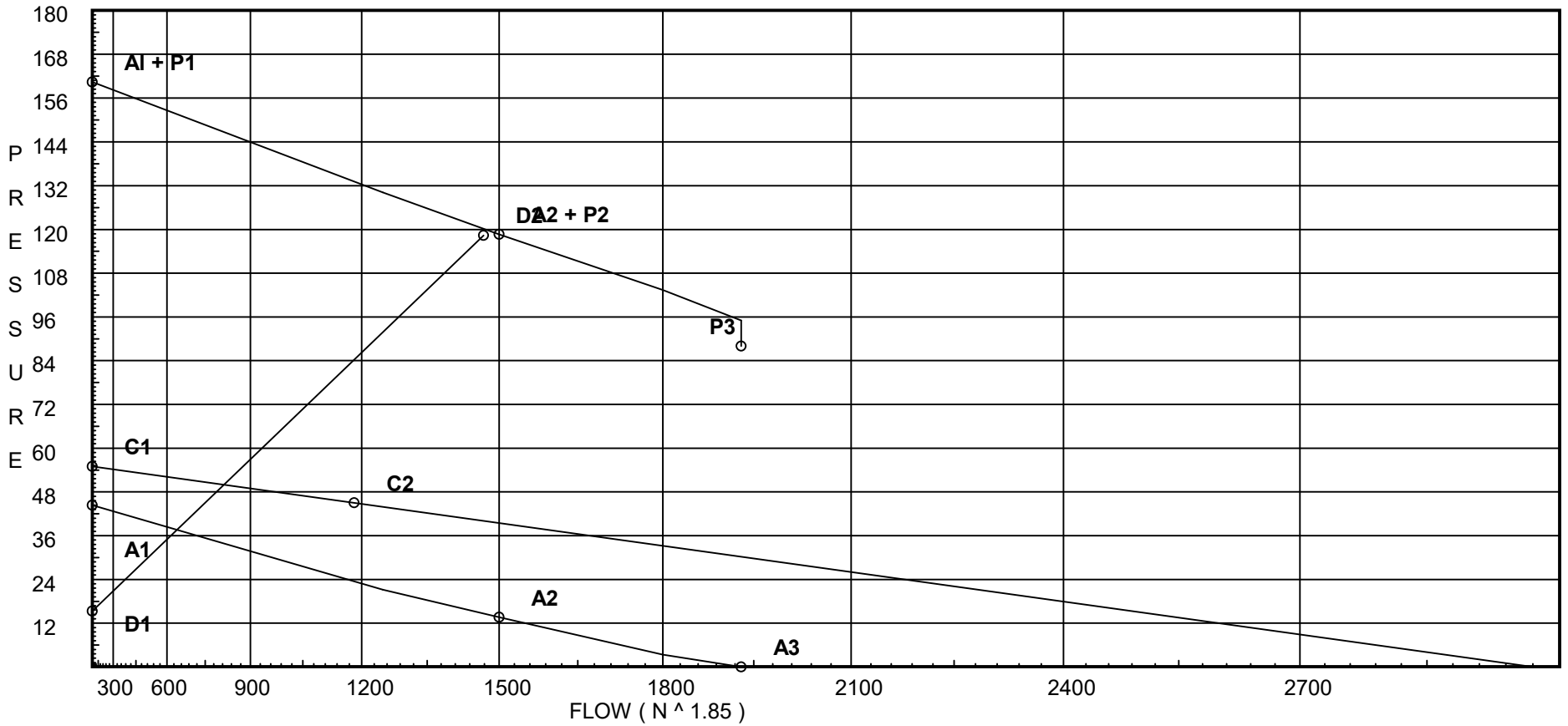
City Water Supply:
- C1 - Static Pressure : 55
- C2 - Residual Pressure: 45
- C2 - Residual Flow : 1182

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

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	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			

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	31.31	16.80	121.15	3			9.000	120	52.000	
to									0.0	
101	31.31		121.15	3.334			9.000	0.0131	0.118	Vel = 4.45
101	31.31	16.80	121.28	3	T	22.488	5.260	120	52.118	
to							22.488		0.0	
102	31.31		242.43	3.334			27.748	0.0471	1.307	Vel = 8.91
102	31.31		-61.78	3	T	22.488	2.810	120	53.425	
to							22.488		1.217	
103	28.5		180.65	3.334			25.298	0.0274	0.692	Vel = 6.64
103	28.5		358.82	4			10.000	120	55.334	
to									0.0	
104	28.5		539.47	4.26			10.000	0.0628	0.628	Vel = 12.14
104	28.5		-270.00	4			10.000	120	55.962	
to									0.0	
105	28.5		269.47	4.26			10.000	0.0173	0.173	Vel = 6.07
105	28.5		0.0	3	T	22.488	4.440	120	56.135	
to							22.488		-1.923	
106	32.94		269.47	3.334			26.928	0.0573	1.544	Vel = 9.90
106	32.94		0.0	3	2T	44.976	612.120	120	55.756	
to					3E	31.483	76.459		0.0	
107	32.94		269.47	3.334			688.579	0.0573	39.464	Vel = 9.90
107	32.94		0.0	3	T	22.488	4.440	120	95.220	
to							22.488		1.923	
108	28.5		269.47	3.334			26.928	0.0573	1.543	Vel = 9.90
108	28.5		1198.49	8	6E	126.847	190.030	120	98.686	
to							126.847		1.083	
TOR	26		1467.96	8.249			316.877	0.0160	5.070	Vel = 8.81
TOR	26		0.0	8	T	41.108	24.230	120	104.839	
to					B	14.094	55.202		11.034	* * Fixed Loss = 0.54
BOR	1.77		1467.96	8.249			79.432	0.0160	1.272	Vel = 8.81
BOR	1.77		0.0	8	E	21.141	14.150	120	117.145	
to					T	41.108	62.249		0.0	
PO	1.77		1467.96	8.249			76.399	0.0160	1.222	Vel = 8.81
			0.0							
PO			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	1.77		0.0	8	2E	42.282	14.550	120	14.666	
to							42.282		-0.087	
UG	1.97		1467.96	8.249			56.832	0.0160	0.910	Vel = 8.81
UG	1.97		0.0	8	4E	85.618	132.970	120	15.489	
to					T	41.62	127.238		8.586	* * Fixed Loss = 6
U1	-4		1467.96	8.27			260.208	0.0158	4.113	Vel = 8.77
U1	-4		-744.55	12	6E	253.171	1528.960	140	28.188	
to							253.171		0.0	
U2	-4		723.41	12.34			1782.131	0.0005	0.814	Vel = 1.94

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	-4		240.81	12	2T	187.534	81.500	140	29.002	
to							187.534		0.0	
U3	-4		964.22	12.34			269.034	0.0008	0.209	Vel = 2.59
U3	-4		19.69	12			135.360	140	29.211	
to									0.0	
SRS	-4		983.91	12.34			135.360	0.0008	0.110	Vel = 2.64
			0.0							
SRS			983.91						29.321	K Factor = 181.70
109	29.67	16.80	121.59	3			9.000	120	52.378	
to									0.0	
110	29.67		121.59	3.334			9.000	0.0131	0.118	Vel = 4.47
110	29.67	16.80	121.72	3	T	22.488	5.260	120	52.496	
to							22.488		0.0	
111	29.67		243.31	3.334			27.748	0.0475	1.317	Vel = 8.94
111	29.67		-64.07	3	T	22.488	1.170	120	53.813	
to							22.488		0.507	
112	28.5		179.24	3.334			23.658	0.0269	0.637	Vel = 6.59
112	28.5		0.0	4			10.000	120	54.957	
to									0.0	
113	28.5		179.24	4.26			10.000	0.0082	0.082	Vel = 4.03
113	28.5		179.58	4			10.000	120	55.039	
to									0.0	
103	28.5		358.82	4.26			10.000	0.0295	0.295	Vel = 8.08
			0.0							
103			358.82						55.334	K Factor = 48.24
114	30.49	16.80	121.25	3			9.000	120	52.088	
to									0.0	
115	30.49		121.25	3.334			9.000	0.0130	0.117	Vel = 4.46
115	30.49	16.80	121.38	3	T	22.488	5.260	120	52.205	
to							22.488		0.0	
116	30.49		242.63	3.334			27.748	0.0472	1.310	Vel = 8.92
116	30.49		-63.04	3	T	22.488	1.990	120	53.515	
to							22.488		0.862	
113	28.5		179.59	3.334			24.478	0.0270	0.662	Vel = 6.60
			0.0							
113			179.59						55.039	K Factor = 24.21
111	29.67		64.08	3	T	22.488	4.740	120	53.813	
to							22.488		0.0	
117	29.67		64.08	3.334			27.228	0.0040	0.109	Vel = 2.35
117	29.67	16.80	123.36	3			10.000	120	53.922	
to									0.0	
118	29.67		187.44	3.334			10.000	0.0293	0.293	Vel = 6.89
118	29.67	16.80	123.70	3			531.980	120	54.215	
to									0.0	
119	29.67		311.14	3.334			531.980	0.0748	39.781	Vel = 11.43
119	29.67		-181.20	3	2T	44.976	1.170	120	93.996	
to							44.976		0.507	
120	28.5		129.94	3.334			46.146	0.0149	0.686	Vel = 4.78

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

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

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

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	-4		240.81	12			270.720	140	28.986	
to									0.0	
U2	-4		240.81	12.34			270.720	0.0001	0.016	Vel = 0.65
			0.0							
U2			240.81						29.002	K Factor = 44.72
U5	-4		19.69	12			49.620	140	29.211	
to									0.0	
U3	-4		19.69	12.34			49.620	0	0.0	Vel = 0.05
			0.0							
U3			19.69						29.211	K Factor = 3.64
104	28.5		270.01	3	T	22.488	3.620	120	55.962	
to							22.488		-1.568	
149	32.12		270.01	3.334			26.108	0.0575	1.502	Vel = 9.92
149	32.12		0.0	3	2T	44.976	612.120	120	55.896	
to					3E	31.483	76.459		0.0	
150	32.12		270.01	3.334			688.579	0.0575	39.610	Vel = 9.92
150	32.12		0.0	3	T	22.488	3.620	120	95.506	
to							22.488		1.568	
127	28.5		270.01	3.334			26.108	0.0575	1.502	Vel = 9.92
			0.0							
127			270.01						98.576	K Factor = 27.20

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December 05, 2022

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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

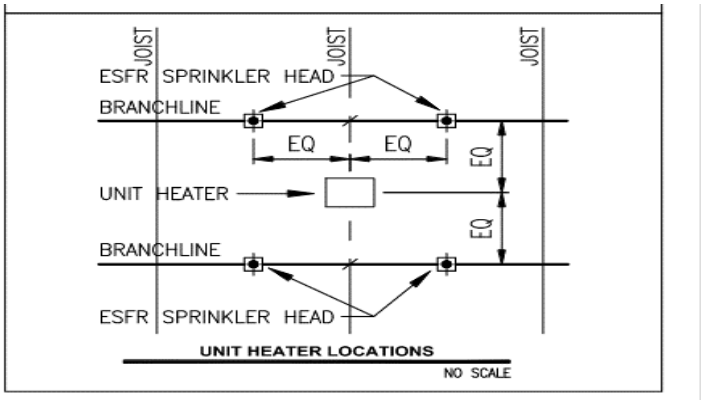

Figure A – Temperature Ratings Near Unit Heaters

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.

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Appendix: Pictures Existing Facility

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Picture 1 – Exterior Combustibles

Picture 2 – Exterior Combustibles