

Hydraulic Calculations

Project: TCF – C4 Facility, Camp Buehring, Kuwait

DESIGN DATA:

Area: SWITCH ROOM, TFC ROOM & UPS / BATTERY ROOM

System Type: Wet

Hazard: Ordinary Hazard System

Design Density: 8.0 mm/min (0.2 gpm/ sq. ft)

Remote Area: 230 sq. m (2500 sq. ft)

Sprinkler Classification: Quick Response (QR)

Maximum Sprinkler Coverage: 130 sq. ft (12 sq m)

Sprinkler K-Factor: 8 (115)

Water flow Duration: One House

CALCULATING NUMBER OF SPRINKLERS IN REMOTE AREA

Using table 9-3 (UFC 3-600-01),

Remote Area = 2500 sq. ft

Area covered by one sprinkler = 130 sq ft. (Ordinary Hazard, NFPA 13)

Number of Sprinklers = Remote Area / Sprinkler Coverage

$$= 2500/130$$

$$= 19.23$$

Rounding off, number of sprinklers in remote area = 20 Nos.

CALCULATING MINIMUM WATER DEMAND

Minimum water demand = Design Density x Design/Remote Area

$$= 0.2 \times 2500 \text{ gpm}$$

$$= 500 \text{ gpm}$$

CALCULATING END SPRINKLER FLOW IN REMOTE AREA

Design Density = 0.2 gpm/sq ft

Maximum area covered by one sprinkler = 0.2 x 130 gpm
= 26 gpm

CALCULATING END SPRINKLER PRESSURE

Using equation.

$$Q = K \times \sqrt{P}$$

Where, Q = Flow in gpm (gallons per minute)

K = Sprinkler constant given by manufacture data sheet

P = Pressure at sprinkler in psi (pound per square inch)

Once the flow (Q) is calculated, the required pressure (P) can be calculated by simply rearranging the above formula:

$$P = \left(\frac{Q}{K}\right)^2$$

Therefore, Pressure required at end sprinkler = $(26/8)^2 = 10.5625$ psi.

This minimum pressure (10.5625 psi) shall be inserted in hydraulic calculation software.

TCF - C4 FACILITY - ZONE 1

Fire Sprinkler Reports

for

US Army
Camp Buehring, Kuwait

Prepared By:

Engr. Kamal Ram
NBTC
Ahmadi, Kuwait

13/02/2021



General Project Data Report

General Data

Project Title:	TCF - C4 Facility - Zone 1	Project File Name:	TCF - C4 Facility Camp Buehring Kuwait Zone Z-1..fiw
Designed By:	Engr. Kamal Ram	Date:	13/02/2021
Code Reference:	NFPA 13, UFC 3-600-01	Approving Agency:	US Army
Client Name:	US Army	Phone:	
Address:	Camp Buehring, Kuwait	City, State Zip Code:	
Company Name:	NBTC	Representative:	
Company Address:	Ahmadi, Kuwait	City And State:	
Phone:			
Building Name:	TCF - C4 Facility	Building Owner:	US Army
Contact at Building:		Phone at Building:	
Address Of Building:		City, State Zip Code:	

Project Data

Description Of Hazard:	Ordinary 1	Sprinkler System Type:	Wet
Design Area Of Water Application:	2500 ft ²	Maximum Area Per Sprinkler:	130 ft ²
Default Sprinkler K-Factor:	8.00 K	Default Pipe Material:	SCHED 40 WET STEEL
Inside Hose Stream Allowance:	0.00 gpm	Outside Hose Stream Allowance:	0.00 gpm
In Rack Sprinkler Allowance:	0.00 gpm		

Sprinkler Specifications

Make:	Model:	
Size:	Temperature Rating:	0 F

Water Supply Test Data

Source Of Information:		Date Of Test:	
Test Hydrant ID:			
Hydrant Elevation:	0 ft	Static Pressure:	0.00 psi
Test Flow Rate:	0.00 gpm	Test Residual Pressure:	0.00 psi
Calculated System Flow Rate:	592.73 gpm	Calculated Inflow Residual Pressure:	61.95 psi

Calculation Project Data

Calculation Mode:	Demand		
HMD Minimum Residual Pressure:	10.56 psi	Minimum Desired Flow Density:	0.20 gpm/ft ²
Number Of Active Nodes:	24		
Number Of Active Pipes:	23	Number Of Inactive Pipes:	0
Number Of Active Sprinklers:	17	Number Of Inactive Sprinklers:	0



Fire Sprinkler Input Data

Node Input Data

Node No.	Node Description Branch Description	Area Group Branch Dia. (in)	Sprinkler KFactor (K) Branch Len. (ft)	Pressure Estimate (psi) Branch Std Fittings	Node Elev (ft) Branch Non- Std Fittings (ft)	Non-Sprinkler Flow (gpm) Branch Sprk KFactor (K)
1	Sprinkler ----	---- 0.000	8.00 0.0	10.56 ----	13.00 0.0	0.00 0.00
2	Sprinkler ----	---- 0.000	8.00 0.0	13.52 ----	13.00 0.0	0.00 0.00
3	Sprinkler ----	---- 0.000	8.00 0.0	16.42 ----	13.00 0.0	0.00 0.00
4	No Discharge ----	---- 0.000	N/A 0.0	24.80 ----	13.00 0.0	0.00 0.00
5	Sprinkler ----	---- 0.000	8.00 0.0	19.66 ----	13.00 0.0	0.00 0.00
6	Sprinkler ----	---- 0.000	8.00 0.0	15.99 ----	13.00 0.0	0.00 0.00
7	Sprinkler ----	---- 0.000	8.00 0.0	16.50 ----	13.00 0.0	0.00 0.00
8	Sprinkler ----	---- 0.000	8.00 0.0	20.28 ----	13.00 0.0	0.00 0.00
9	No Discharge ----	---- 0.000	N/A 0.0	25.57 ----	13.00 0.0	0.00 0.00
10	Sprinkler ----	---- 0.000	8.00 0.0	16.50 ----	13.00 0.0	0.00 0.00
11	Sprinkler ----	---- 0.000	8.00 0.0	20.28 ----	13.00 0.0	0.00 0.00
12	Sprinkler ----	---- 0.000	8.00 0.0	18.15 ----	13.00 0.0	0.00 0.00
13	Sprinkler ----	---- 0.000	8.00 0.0	22.28 ----	13.00 0.0	0.00 0.00
14	No Discharge ----	---- 0.000	N/A 0.0	28.06 ----	13.00 0.0	0.00 0.00
15	Sprinkler ----	---- 0.000	8.00 0.0	22.28 ----	13.00 0.0	0.00 0.00
16	Sprinkler ----	---- 0.000	8.00 0.0	18.15 ----	13.00 0.0	0.00 0.00
17	Sprinkler ----	---- 0.000	8.00 0.0	21.62 ----	13.00 0.0	0.00 0.00
18	Sprinkler ----	---- 0.000	8.00 0.0	26.47 ----	13.00 0.0	0.00 0.00



Fire Sprinkler Input Data

Node Input Data (cont'd)

Node No.	Node Description Branch Description	Area Group Branch Dia. (in)	Sprinkler KFactor (K) Branch Len. (ft)	Pressure Estimate (psi) Branch Stnd Fittings	Node Elev (ft) Branch Non- Stnd Fittings (ft)	Non-Sprinkler Flow (gpm) Branch Sprk KFactor (K)
19	No Discharge ----	---- 0.000	N/A 0.0	33.26 ----	13.00 0.0	0.00 0.00
20	Sprinkler ----	---- 0.000	8.00 0.0	26.47 ----	13.00 0.0	0.00 0.00
21	Sprinkler ----	---- 0.000	8.00 0.0	21.62 ----	13.00 0.0	0.00 0.00
22	No Discharge ----	---- 0.000	N/A 0.0	43.64 ----	13.00 0.0	0.00 0.00
23	No Discharge ----	---- 0.000	N/A 0.0	54.52 ----	13.00 0.0	0.00 0.00
24	No Discharge ----	---- 0.000	N/A 0.0	61.95 ----	0.00 0.0	0.00 0.00



Fire Sprinkler Input Data

Pipe Input Data

Beg. Node	End. Node	Pipe Description	Nominal Diameter (inch)	Type Group	Fitting Data	Nominal Length (feet)	Fitting Length (feet)	Total Length (feet)	CFactor (gpm/inch-psi)
1	2	SCHED 40 WET STEEL	1.000	0	E	12.00	2.00	14.00	120
2	3	SCHED 40 WET STEEL	1.250	0	E	9.84	3.00	12.84	120
3	4	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
6	5	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
5	4	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
7	8	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
8	9	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
11	10	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
11	9	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
4	9	SCHED 40 WET STEEL	3.000	0	T	9.84	15.00	24.84	120
12	13	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
13	14	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
16	15	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
15	14	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
9	14	SCHED 40 WET STEEL	3.000	0	T	9.84	15.00	24.84	120
17	18	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
18	19	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
21	20	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
20	19	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
14	19	SCHED 40 WET STEEL	3.000	0	T	9.84	15.00	24.84	120
19	22	SCHED 40 WET STEEL	4.000	0	2ET	65.50	40.00	105.50	120
22	23	SCHED 40 WET STEEL	4.000	0	4T	30.50	80.00	110.50	120
23	24	SCHED 40 WET STEEL	6.000	0	3EGC	58.00	77.00	135.00	120



Fire Sprinkler Output Data

Overall Node Groupings Output Data

Pipe Segment Beg. Node	Pipe Segment End. Node	Pipe Type Group	Pipe Flow Rate (gpm)	Sprinkler Flow At Beg. Node (gpm)	Non-Sprinkler Flow Out (+) (gpm)	Non-Sprinkler Flow In (-) (gpm)	Beg. Node Residual Pressure (psi)	Imbalance Flow At Beg. Node (gpm)
1	2	0	-26.00	26.00	0.00	0.00	10.56	
2	1	0	26.00	29.42	0.00	0.00	13.52	0.00000
2	3	0	-55.42					
3	2	0	55.42	32.42	0.00	0.00	16.42	0.00000
3	4	0	-87.84					
4	3	0	87.84	0.00	0.00	0.00	24.80	0.00000
4	5	0	67.46					
4	9	0	-155.30					
5	4	0	-67.46	35.47	0.00	0.00	19.66	0.00000
5	6	0	31.99					
6	5	0	-31.99	31.99	0.00	0.00	15.99	0.00000
7	8	0	-32.49	32.49	0.00	0.00	16.50	0.00000
8	7	0	32.49	36.03	0.00	0.00	20.28	0.00000
8	9	0	-68.52					
9	4	0	155.30	0.00	0.00	0.00	25.57	0.00000
9	8	0	68.52					
9	11	0	68.52					
9	14	0	-292.33					
10	11	0	-32.49	32.49	0.00	0.00	16.50	0.00000
11	9	0	-68.52	36.03	0.00	0.00	20.28	0.00000
11	10	0	32.49					
12	13	0	-34.08	34.08	0.00	0.00	18.15	0.00000
13	12	0	34.08	37.76	0.00	0.00	22.28	0.00000
13	14	0	-71.84					
14	9	0	292.33	0.00	0.00	0.00	28.06	0.00000
14	13	0	71.84					
14	15	0	71.84					
14	19	0	-436.01					
15	14	0	-71.84	37.76	0.00	0.00	22.28	0.00000
15	16	0	34.08					
16	15	0	-34.08	34.08	0.00	0.00	18.15	0.00000
17	18	0	-37.20	37.20	0.00	0.00	21.62	0.00000
18	17	0	37.20	41.16	0.00	0.00	26.47	0.00000
18	19	0	-78.36					
19	14	0	436.01	0.00	0.00	0.00	33.26	0.00000
19	18	0	78.36					
19	20	0	78.36					
19	22	0	-592.73					



Fire Sprinkler Output Data

Overall Node Groupings Output Data (cont'd)

Pipe Segment Beg. Node	End. Node	Pipe Type Group	Pipe Flow Rate (gpm)	Sprinkler Flow At Beg. Node (gpm)	Non-Sprinkler Flow Out (+) (gpm)	Non-Sprinkler Flow In (-) (gpm)	Beg. Node Residual Pressure (psi)	Imbalance Flow At Beg. Node (gpm)
20	19	0	-78.36	41.16	0.00	0.00	26.47	0.00000
20	21	0	37.20					
21	20	0	-37.20	37.20	0.00	0.00	21.62	0.00000
22	19	0	592.73	0.00	0.00	0.00	43.64	0.00000
22	23	0	-592.73					
23	22	0	592.73	0.00	0.00	0.00	54.52	0.00000
23	24	0	-592.73					
24	23	0	592.73	0.00	0.00	-592.73	61.95	



Fire Sprinkler Output Data

Overall Pipe Output Data

Beg. End. Node	Nodal KFactor (K)	Elevation (feet)	Spk/Hose Discharge (gpm)	Residual Pressure (psi)	Nom. Dia. Inside Dia. C-Value	q (gpm) Q (gpm) Velocity (fps)	F. L./ft (psi/ft) Fittings Type-Grp	Pipe-Len. Fit-Len. Tot-Len. (ft)	PF-(psi) PE-(psi) PT-(psi)
1	8.00	13.00	26.00	10.56	1.00	26.00	0.21153	12.00	2.961
2	8.00	13.00	29.42	13.52	1.049	26.00	E	2.00	0.000
	SCHED 40 WET STEEL				120	9.65	0	14.00	2.961
2	8.00	13.00	29.42	13.52	1.25	29.42	0.22567	9.84	2.898
3	8.00	13.00	32.42	16.42	1.380	55.42	E	3.00	0.000
	SCHED 40 WET STEEL				120	11.89	0	12.84	2.898
3	8.00	13.00	32.42	16.42	1.25	32.42	0.52909	9.84	8.381
4	0.00	13.00	0.00	24.80	1.380	87.84	T	6.00	0.000
	SCHED 40 WET STEEL				120	18.84	0	15.84	8.381
5	8.00	13.00	35.47	19.66	1.25	35.47	0.32464	9.84	5.142
4	0.00	13.00	0.00	24.80	1.380	67.46	T	6.00	0.000
	SCHED 40 WET STEEL				120	14.47	0	15.84	5.142
6	8.00	13.00	31.99	15.99	1.00	31.99	0.31035	9.84	3.675
5	8.00	13.00	35.47	19.66	1.049	31.99	E	2.00	0.000
	SCHED 40 WET STEEL				120	11.87	0	11.84	3.675
7	8.00	13.00	32.49	16.50	1.00	32.49	0.31952	9.84	3.783
8	8.00	13.00	36.03	20.28	1.049	32.49	E	2.00	0.000
	SCHED 40 WET STEEL				120	12.06	0	11.84	3.783
4	0.00	13.00	0.00	24.80	3.00	0.00	0.03102	9.84	0.770
9	0.00	13.00	0.00	25.57	3.068	155.30	T	15.00	0.000
	SCHED 40 WET STEEL				120	6.74	0	24.84	0.770
8	8.00	13.00	36.03	20.28	1.25	36.03	0.33416	9.84	5.293
9	0.00	13.00	0.00	25.57	1.380	68.52	T	6.00	0.000
	SCHED 40 WET STEEL				120	14.70	0	15.84	5.293
11	8.00	13.00	36.03	20.28	1.25	36.03	0.33416	9.84	5.293
9	0.00	13.00	0.00	25.57	1.380	68.52	T	6.00	0.000
	SCHED 40 WET STEEL				120	14.70	0	15.84	5.293
11	8.00	13.00	36.03	20.28	1.00	32.49	0.31952	9.84	3.783
10	8.00	13.00	32.49	16.50	1.049	32.49	E	2.00	0.000
	SCHED 40 WET STEEL				120	12.06	0	11.84	3.783
12	8.00	13.00	34.08	18.15	1.00	34.08	0.34898	9.84	4.132
13	8.00	13.00	37.76	22.28	1.049	34.08	E	2.00	0.000
	SCHED 40 WET STEEL				120	12.65	0	11.84	4.132
9	0.00	13.00	0.00	25.57	3.00	0.00	0.09997	9.84	2.483
14	0.00	13.00	0.00	28.06	3.068	292.33	T	15.00	0.000
	SCHED 40 WET STEEL				120	12.69	0	24.84	2.483
13	8.00	13.00	37.76	22.28	1.25	37.76	0.36473	9.84	5.777
14	0.00	13.00	0.00	28.06	1.380	71.84	T	6.00	0.000
	SCHED 40 WET STEEL				120	15.41	0	15.84	5.777



Fire Sprinkler Output Data

Overall Pipe Output Data (cont'd)

Beg. End. Node	Nodal KFactor (K)	Elevation (feet)	Spk/Hose Discharge (gpm)	Residual Pressure (psi)	Nom. Dia. Inside Dia. C-Value	q (gpm) Q (gpm) Velocity (fps)	F. L./ft (psi/ft) Fittings Type-Grp	Pipe-Len. Fit-Len. Tot-Len. (ft)	PF-(psi) PE-(psi) PT-(psi)
15	8.00	13.00	37.76	22.28	1.25	37.76	0.36473	9.84	5.777
14	0.00	13.00	0.00	28.06	1.380	71.84	T	6.00	0.000
	SCHED 40 WET STEEL				120	15.41	0	15.84	5.777
16	8.00	13.00	34.08	18.15	1.00	34.08	0.34898	9.84	4.132
15	8.00	13.00	37.76	22.28	1.049	34.08	E	2.00	0.000
	SCHED 40 WET STEEL				120	12.65	0	11.84	4.132
17	8.00	13.00	37.20	21.62	1.00	37.20	0.41029	9.84	4.858
18	8.00	13.00	41.16	26.47	1.049	37.20	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.81	0	11.84	4.858
14	0.00	13.00	0.00	28.06	3.00	0.00	0.20946	9.84	5.203
19	0.00	13.00	0.00	33.26	3.068	436.01	T	15.00	0.000
	SCHED 40 WET STEEL				120	18.92	0	24.84	5.203
18	8.00	13.00	41.16	26.47	1.25	41.16	0.42831	9.84	6.784
19	0.00	13.00	0.00	33.26	1.380	78.36	T	6.00	0.000
	SCHED 40 WET STEEL				120	16.81	0	15.84	6.784
20	8.00	13.00	41.16	26.47	1.25	41.16	0.42831	9.84	6.784
19	0.00	13.00	0.00	33.26	1.380	78.36	T	6.00	0.000
	SCHED 40 WET STEEL				120	16.81	0	15.84	6.784
21	8.00	13.00	37.20	21.62	1.00	37.20	0.41029	9.84	4.858
20	8.00	13.00	41.16	26.47	1.049	37.20	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.81	0	11.84	4.858
19	0.00	13.00	0.00	33.26	4.00	0.00	0.09842	65.50	10.383
22	0.00	13.00	0.00	43.64	4.026	592.73	2ET	40.00	0.000
	SCHED 40 WET STEEL				120	14.94	0	105.50	10.383
22	0.00	13.00	0.00	43.64	4.00	0.00	0.09842	30.50	10.876
23	0.00	13.00	0.00	54.52	4.026	592.73	4T	80.00	0.000
	SCHED 40 WET STEEL				120	14.94	0	110.50	10.876
23	0.00	13.00	0.00	54.52	6.00	0.00	0.01338	58.00	1.806
24	0.00	0.00	0.00	61.95	6.065	592.73	3EGC	77.00	5.629
	SCHED 40 WET STEEL				120	6.58	0	135.00	7.435



Fire Sprinkler Output Data

Overall Sprinkler Output Data

Flowing Sprinkler Node No.	Area Group Code	Sprinkler KFactor (K)	Sprinkler Elevation (feet)	Residual Pressure (psi)	Flowing Area (ft²)	Flowing Density (gpm/ft²)	Sprinkler Discharge (gpm)
1		8.00	13.00	10.56	130.00	0.200	26.00
Sub Totals For Non-Group					130.00	0.200	26.00
2		8.00	13.00	13.52	130.00	0.226	29.42
Sub Totals For Non-Group					130.00	0.226	29.42
3		8.00	13.00	16.42	130.00	0.249	32.42
Sub Totals For Non-Group					130.00	0.249	32.42
5		8.00	13.00	19.66	130.00	0.273	35.47
Sub Totals For Non-Group					130.00	0.273	35.47
6		8.00	13.00	15.99	130.00	0.246	31.99
Sub Totals For Non-Group					130.00	0.246	31.99
7		8.00	13.00	16.50	130.00	0.250	32.49
Sub Totals For Non-Group					130.00	0.250	32.49
8		8.00	13.00	20.28	130.00	0.277	36.03
Sub Totals For Non-Group					130.00	0.277	36.03
10		8.00	13.00	16.50	130.00	0.250	32.49
Sub Totals For Non-Group					130.00	0.250	32.49
11		8.00	13.00	20.28	130.00	0.277	36.03
Sub Totals For Non-Group					130.00	0.277	36.03
12		8.00	13.00	18.15	130.00	0.262	34.08
Sub Totals For Non-Group					130.00	0.262	34.08
13		8.00	13.00	22.28	130.00	0.290	37.76
Sub Totals For Non-Group					130.00	0.290	37.76
15		8.00	13.00	22.28	130.00	0.290	37.76
Sub Totals For Non-Group					130.00	0.290	37.76
16		8.00	13.00	18.15	130.00	0.262	34.08
Sub Totals For Non-Group					130.00	0.262	34.08
17		8.00	13.00	21.62	130.00	0.286	37.20
Sub Totals For Non-Group					130.00	0.286	37.20
18		8.00	13.00	26.47	130.00	0.317	41.16
Sub Totals For Non-Group					130.00	0.317	41.16
20		8.00	13.00	26.47	130.00	0.317	41.16
Sub Totals For Non-Group					130.00	0.317	41.16
21		8.00	13.00	21.62	130.00	0.286	37.20
Sub Totals For Non-Group					130.00	0.286	37.20
Totals For All Groups					2210.00	0.268	592.73



Fire Sprinkler Output Summary

Hydraulically Most Demanding Sprinkler Node

HMD Sprinkler Node Number: 1
HMD Actual Residual Pressure: 10.56 psi
HMD Actual Flow: 26.00 gpm

Sprinkler Summary

Sprinkler System Type: Wet
Specified Area Of Application: 2500.00 ft²
Minimum Desired Density: 0.200 gpm/ft²
Application Average Density: 0.237 gpm/ft²
Application Average Area Per Sprinkler: 147.06 ft²
Sprinkler Flow: 592.73 gpm
Average Sprinkler Flow: 34.87 gpm

Flow Velocity And Imbalance Summary

Maximum Flow Velocity (In Pipe 14 - 19) 18.92 ft/sec
Maximum Velocity Pressure (In Pipe 14 - 19) 2.41 psi

Allowable Maximum Nodal Pressure Imbalance: 0.0000 psi
Actual Maximum Nodal Pressure Imbalance: 0.0000 psi
Actual Average Nodal Pressure Imbalance: 0.0000 psi
Actual Maximum Nodal Flow Imbalance: 0.0000 gpm
Actual Average Nodal Flow Imbalance: 0.0000 gpm

Overall Network Summary

Number Of Unique Pipe Sections: 23
Number Of Flowing Sprinklers: 17

Pipe System Water Volume: 172.38 gal

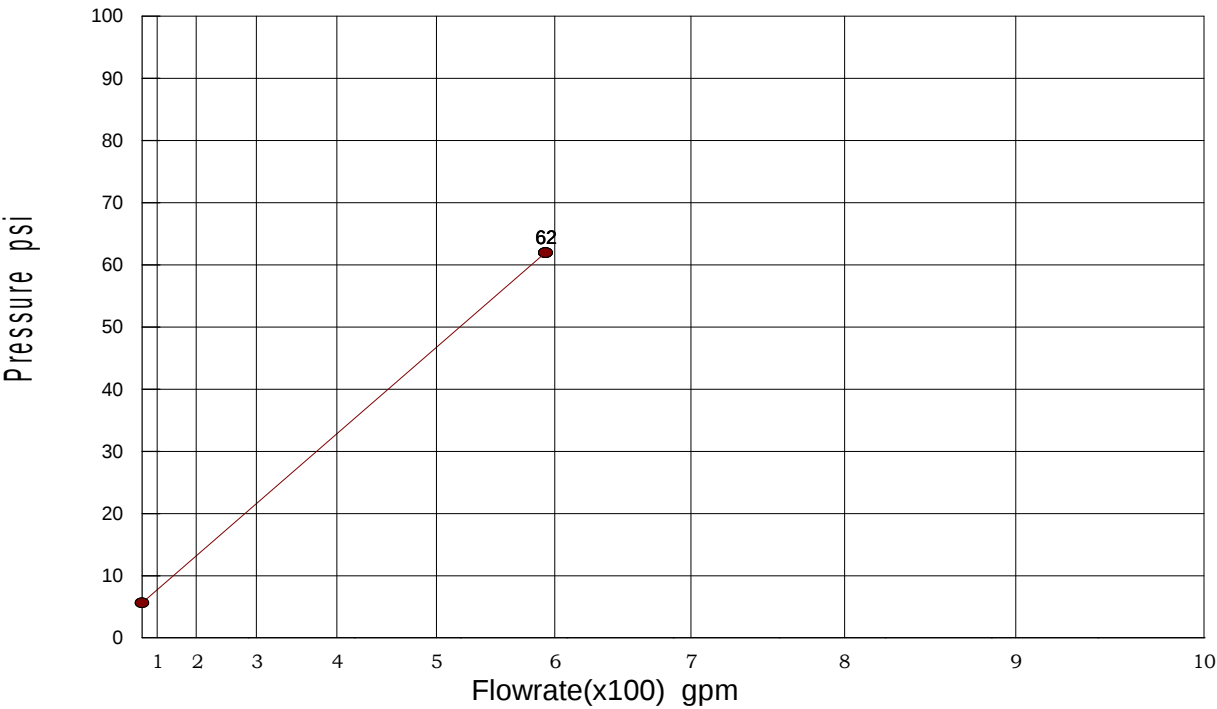
Sprinkler Flow: 592.73 gpm
Non-Sprinkler Flow: 0.00 gpm

Minimum Required Residual Pressure At System Inflow Node: 61.95 psi
Demand Flow At System Inflow Node: 592.73 gpm



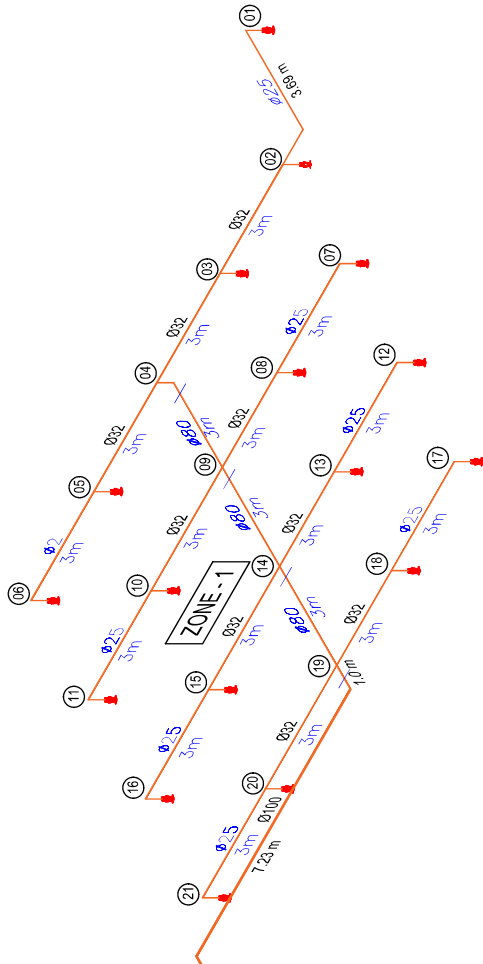
Fire Sprinkler Output Data

Hydraulic Supply/Demand Graph

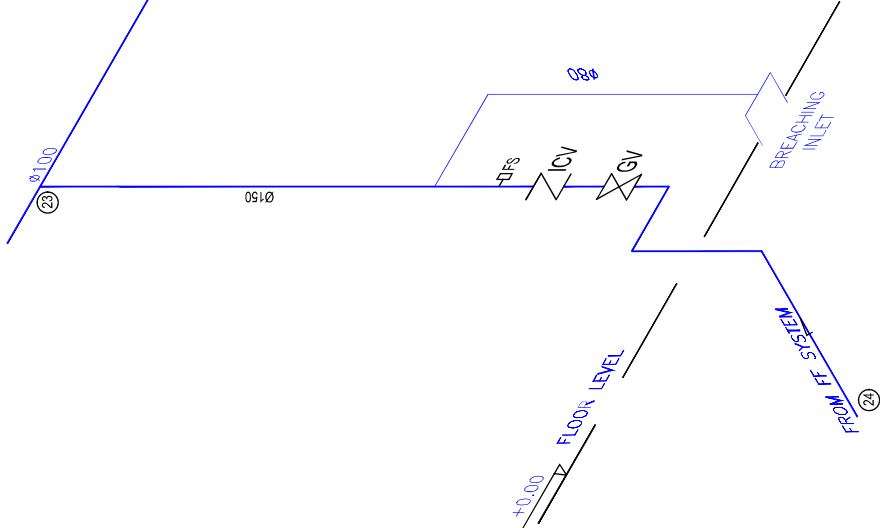


Demand Curve Data

Calculated Residual Pressure: 61.95 psi
Calculated Flow Rate: 592.73 gpm
Pressure Required For First Sprinkler Downstream From Inflow Node To Flow: 5.63 psi



ZONE - 1
ISOMETRIC DIAGRAM



Checked	Name :	Signature :	Revision Details :	Date :	Client :	Contractor :	Title :	Drawing Name :
Drawn	ENGR. KAMAL	09-03-2021					TCF - C4 Facility Camp Buehring, Kuwait	Repair Wet Pipe Fire Suppression System ZONE-1 (ISOMETRIC DIAGRAM)
Design	ENGR. KAMAL							Drawing Unit : MILLIMETER
Issued	PROPOSAL DESIGN							Drawing Scale : NTS
Transmital #								Drawing No : FF-04

BU15-0097

Naser M. Al-Baddah & Partner
MEP Division
General Trading & Contracting Co. W.L.L.
P.O.Box 9088, Almadia-61001, Kuwait.

**AIR FORCE ENVIRONMENTAL
OF EXCELLENCE (AFCEE)**

TCF - C4 FACILITY - ZONE 2

Fire Sprinkler Reports

for

US Army
Camp Buehring, Kuwait

Prepared By:

Engr. Kamal Ram
NBTC
Ahmadi, Kuwait

13/02/2021



General Project Data Report

General Data

Project Title:	TCF - C4 Facility - Zone 2	Project File Name:	TCF - C4 Facility Camp Buehring Kuwait Zone Z-2..fiw
Designed By:	Engr. Kamal Ram	Date:	13/02/2021
Code Reference:	NFPA 13, UFC 3-600-01	Approving Agency:	US Army
Client Name:	US Army	Phone:	
Address:	Camp Buehring, Kuwait	City, State Zip Code:	
Company Name:	NBTC	Representative:	
Company Address:	Ahmadi, Kuwait	City And State:	
Phone:			
Building Name:	TCF - C4 Facility	Building Owner:	US Army
Contact at Building:		Phone at Building:	
Address Of Building:		City, State Zip Code:	

Project Data

Description Of Hazard:	Ordinary 1	Sprinkler System Type:	Wet
Design Area Of Water Application:	2500 ft ²	Maximum Area Per Sprinkler:	130 ft ²
Default Sprinkler K-Factor:	8.00 K	Default Pipe Material:	SCHED 40 WET STEEL
Inside Hose Stream Allowance:	0.00 gpm	Outside Hose Stream Allowance:	0.00 gpm
In Rack Sprinkler Allowance:	0.00 gpm		

Sprinkler Specifications

Make:	Model:	
Size:	Temperature Rating:	0 F

Water Supply Test Data

Source Of Information:		Date Of Test:	
Test Hydrant ID:			
Hydrant Elevation:	0 ft	Static Pressure:	0.00 psi
Test Flow Rate:	0.00 gpm	Test Residual Pressure:	0.00 psi
Calculated System Flow Rate:	694.12 gpm	Calculated Inflow Residual Pressure:	64.11 psi

Calculation Project Data

Calculation Mode:	Demand		
HMD Minimum Residual Pressure:	10.56 psi	Minimum Desired Flow Density:	0.20 gpm/ft ²
Number Of Active Nodes:	27		
Number Of Active Pipes:	26	Number Of Inactive Pipes:	0
Number Of Active Sprinklers:	19	Number Of Inactive Sprinklers:	0



Fire Sprinkler Input Data

Node Input Data

Node No.	Node Description Branch Description	Area Group Branch Dia. (in)	Sprinkler KFactor (K) Branch Len. (ft)	Pressure Estimate (psi) Branch Std Fittings	Node Elev (ft) Branch Non- Std Fittings (ft)	Non-Sprinkler Flow (gpm) Branch Sprk KFactor (K)
1	Sprinkler ----	---- 0.000	8.00 0.0	10.56 ----	13.00 0.0	0.00 0.00
2	Sprinkler ----	---- 0.000	8.00 0.0	13.07 ----	13.00 0.0	0.00 0.00
3	No Discharge ----	---- 0.000	N/A 0.0	16.58 ----	13.00 0.0	0.00 0.00
4	Sprinkler ----	---- 0.000	8.00 0.0	12.83 ----	13.00 0.0	0.00 0.00
5	Sprinkler ----	---- 0.000	8.00 0.0	22.09 ----	13.00 0.0	0.00 0.00
6	Sprinkler ----	---- 0.000	8.00 0.0	24.75 ----	13.00 0.0	0.00 0.00
7	No Discharge ----	---- 0.000	N/A 0.0	29.25 ----	13.00 0.0	0.00 0.00
8	Sprinkler ----	---- 0.000	8.00 0.0	24.19 ----	13.00 0.0	0.00 0.00
9	Sprinkler ----	---- 0.000	8.00 0.0	19.73 ----	13.00 0.0	0.00 0.00
10	Sprinkler ----	---- 0.000	8.00 0.0	19.42 ----	13.00 0.0	0.00 0.00
11	Sprinkler ----	---- 0.000	8.00 0.0	23.81 ----	13.00 0.0	0.00 0.00
12	No Discharge ----	---- 0.000	N/A 0.0	29.96 ----	13.00 0.0	0.00 0.00
13	Sprinkler ----	---- 0.000	8.00 0.0	23.81 ----	13.00 0.0	0.00 0.00
14	Sprinkler ----	---- 0.000	8.00 0.0	19.42 ----	13.00 0.0	0.00 0.00
15	Sprinkler ----	---- 0.000	8.00 0.0	20.29 ----	13.00 0.0	0.00 0.00
16	Sprinkler ----	---- 0.000	8.00 0.0	24.88 ----	13.00 0.0	0.00 0.00
17	No Discharge ----	---- 0.000	N/A 0.0	31.28 ----	13.00 0.0	0.00 0.00
18	Sprinkler ----	---- 0.000	8.00 0.0	24.88 ----	13.00 0.0	0.00 0.00



Fire Sprinkler Input Data

Node Input Data (cont'd)

Node No.	Node Description Branch Description	Area Group Branch Dia. (in)	Sprinkler KFactor (K) Branch Len. (ft)	Pressure Estimate (psi) Branch Std Fittings	Node Elev (ft) Branch Non- Std Fittings (ft)	Non-Sprinkler Flow (gpm) Branch Sprk KFactor (K)
19	Sprinkler ----	---- 0.000	8.00 0.0	20.29 ----	13.00 0.0	0.00 0.00
20	Sprinkler ----	---- 0.000	8.00 0.0	21.92 ----	13.00 0.0	0.00 0.00
21	Sprinkler ----	---- 0.000	8.00 0.0	26.85 ----	13.00 0.0	0.00 0.00
22	No Discharge ----	---- 0.000	N/A 0.0	33.72 ----	13.00 0.0	0.00 0.00
23	Sprinkler ----	---- 0.000	8.00 0.0	26.85 ----	13.00 0.0	0.00 0.00
24	Sprinkler ----	---- 0.000	8.00 0.0	21.92 ----	13.00 0.0	0.00 0.00
25	No Discharge ----	---- 0.000	N/A 0.0	41.50 ----	13.00 0.0	0.00 0.00
26	No Discharge ----	---- 0.000	N/A 0.0	56.06 ----	13.00 0.0	0.00 0.00
27	No Discharge ----	---- 0.000	N/A 0.0	64.11 ----	0.00 0.0	0.00 0.00



Fire Sprinkler Input Data

Pipe Input Data

Beg. Node	End. Node	Pipe Description	Nominal Diameter (inch)	Type Group	Fitting Data	Nominal Length (feet)	Fitting Length (feet)	Total Length (feet)	CFactor (gpm/inch-psi)
1	2	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
2	3	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
4	3	SCHED 40 WET STEEL	1.000	0	T	9.84	5.00	14.84	120
3	5	SCHED 40 WET STEEL	1.500	0	T	16.17	8.00	24.17	120
5	6	SCHED 40 WET STEEL	2.000	0	T	9.84	10.00	19.84	120
6	7	SCHED 40 WET STEEL	2.000	0	T	9.84	10.00	19.84	120
9	8	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
8	7	SCHED 40 WET STEEL	1.250	0	E	9.84	3.00	12.84	120
10	11	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
11	12	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
14	13	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
13	12	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
7	12	SCHED 40 WET STEEL	4.000	0	ET	9.84	30.00	39.84	120
15	16	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
16	17	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
19	18	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
18	17	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
12	17	SCHED 40 WET STEEL	4.000	0	T	9.84	20.00	29.84	120
20	21	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
21	22	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
24	23	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
23	22	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
17	22	SCHED 40 WET STEEL	4.000	0	T	9.84	20.00	29.84	120
22	25	SCHED 40 WET STEEL	4.000	0	ET	29.00	30.00	59.00	120
25	26	SCHED 40 WET STEEL	4.000	0	4T	30.50	80.00	110.50	120
26	27	SCHED 40 WET STEEL	6.000	0	3EGC	58.00	77.00	135.00	120



Fire Sprinkler Output Data

Overall Node Groupings Output Data

Pipe Segment Beg. Node	Pipe Segment End. Node	Pipe Type Group	Pipe Flow Rate (gpm)	Sprinkler Flow At Beg. Node (gpm)	Non-Sprinkler Flow Out (+) (gpm)	Non-Sprinkler Flow In (-) (gpm)	Beg. Node Residual Pressure (psi)	Imbalance Flow At Beg. Node (gpm)
1	2	0	-26.00	26.00	0.00	0.00	10.56	
2	1	0	26.00	28.92	0.00	0.00	13.07	0.00000
2	3	0	-54.92					
3	2	0	54.92	0.00	0.00	0.00	16.58	0.00000
3	4	0	28.65					
3	5	0	-83.57					
4	3	0	-28.65	28.65	0.00	0.00	12.83	0.00000
5	3	0	83.57	37.60	0.00	0.00	22.09	0.00000
5	6	0	-121.17					
6	5	0	121.17	39.80	0.00	0.00	24.75	0.00000
6	7	0	-160.96					
7	6	0	160.96	0.00	0.00	0.00	29.25	0.00000
7	8	0	74.88					
7	12	0	-235.84					
8	7	0	-74.88	39.35	0.00	0.00	24.19	0.00000
8	9	0	35.53					
9	8	0	-35.53	35.53	0.00	0.00	19.73	0.00000
10	11	0	-35.25	35.25	0.00	0.00	19.42	0.00000
11	10	0	35.25	39.04	0.00	0.00	23.81	0.00000
11	12	0	-74.29					
12	7	0	235.84	0.00	0.00	0.00	29.96	0.00000
12	11	0	74.29					
12	13	0	74.29					
12	17	0	-384.42					
13	12	0	-74.29	39.04	0.00	0.00	23.81	0.00000
13	14	0	35.25					
14	13	0	-35.25	35.25	0.00	0.00	19.42	0.00000
15	16	0	-36.04	36.04	0.00	0.00	20.29	0.00000
16	15	0	36.04	39.90	0.00	0.00	24.88	0.00000
16	17	0	-75.94					
17	12	0	384.42	0.00	0.00	0.00	31.28	0.00000
17	16	0	75.94					
17	18	0	75.94					
17	22	0	-536.30					
18	17	0	-75.94	39.90	0.00	0.00	24.88	0.00000
18	19	0	36.04					
19	18	0	-36.04	36.04	0.00	0.00	20.29	0.00000



Fire Sprinkler Output Data

Overall Node Groupings Output Data (cont'd)

Pipe Segment Beg. Node	End. Node	Pipe Type Group	Pipe Flow Rate (gpm)	Sprinkler Flow At Beg. Node (gpm)	Non-Sprinkler Flow Out (+) (gpm)	Non-Sprinkler Flow In (-) (gpm)	Beg. Node Residual Pressure (psi)	Imbalance Flow At Beg. Node (gpm)
20	21	0	-37.46	37.46	0.00	0.00	21.92	0.00000
21	20	0	37.46	41.45	0.00	0.00	26.85	0.00000
21	22	0	-78.91					
22	17	0	536.30	0.00	0.00	0.00	33.72	0.00000
22	21	0	78.91					
22	23	0	78.91					
22	25	0	-694.12					
23	22	0	-78.91	41.45	0.00	0.00	26.85	0.00000
23	24	0	37.46					
24	23	0	-37.46	37.46	0.00	0.00	21.92	0.00000
25	22	0	694.12	0.00	0.00	0.00	41.50	0.00000
25	26	0	-694.12					
26	25	0	694.12	0.00	0.00	0.00	56.06	0.00000
26	27	0	-694.12					
27	26	0	694.12	0.00	0.00	-694.12	64.11	



Fire Sprinkler Output Data

Overall Pipe Output Data

Beg. End. Node	Nodal KFactor (K)	Elevation (feet)	Spk/Hose Discharge (gpm)	Residual Pressure (psi)	Nom. Dia. Inside Dia. C-Value	q (gpm) Q (gpm) Velocity (fps)	F. L./ft (psi/ft) Fittings Type-Grp	Pipe-Len. Fit-Len. Tot-Len. (ft)	PF-(psi) PE-(psi) PT-(psi)
1	8.00	13.00	26.00	10.56	1.00	26.00	0.21153	9.84	2.505
2	8.00	13.00	28.92	13.07	1.049	26.00	E	2.00	0.000
	SCHED 40 WET STEEL				120	9.65	0	11.84	2.505
2	8.00	13.00	28.92	13.07	1.25	28.92	0.22190	9.84	3.515
3	0.00	13.00	0.00	16.58	1.380	54.92	T	6.00	0.000
	SCHED 40 WET STEEL				120	11.78	0	15.84	3.515
4	8.00	13.00	28.65	12.83	1.00	28.65	0.25314	9.84	3.757
3	0.00	13.00	0.00	16.58	1.049	28.65	T	5.00	0.000
	SCHED 40 WET STEEL				120	10.64	0	14.84	3.757
3	0.00	13.00	0.00	16.58	1.50	0.00	0.22775	16.17	5.505
5	8.00	13.00	37.60	22.09	1.610	83.57	T	8.00	0.000
	SCHED 40 WET STEEL				120	13.17	0	24.17	5.505
5	8.00	13.00	37.60	22.09	2.00	37.60	0.13412	9.84	2.661
6	8.00	13.00	39.80	24.75	2.067	121.17	T	10.00	0.000
	SCHED 40 WET STEEL				120	11.58	0	19.84	2.661
6	8.00	13.00	39.80	24.75	2.00	39.80	0.22683	9.84	4.500
7	0.00	13.00	0.00	29.25	2.067	160.96	T	10.00	0.000
	SCHED 40 WET STEEL				120	15.39	0	19.84	4.500
8	8.00	13.00	39.35	24.19	1.25	39.35	0.39381	9.84	5.056
7	0.00	13.00	0.00	29.25	1.380	74.88	E	3.00	0.000
	SCHED 40 WET STEEL				120	16.06	0	12.84	5.056
9	8.00	13.00	35.53	19.73	1.00	35.53	0.37701	9.84	4.464
8	8.00	13.00	39.35	24.19	1.049	35.53	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.19	0	11.84	4.464
10	8.00	13.00	35.25	19.42	1.00	35.25	0.37148	9.84	4.398
11	8.00	13.00	39.04	23.81	1.049	35.25	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.09	0	11.84	4.398
7	0.00	13.00	0.00	29.25	4.00	0.00	0.01789	9.84	0.713
12	0.00	13.00	0.00	29.96	4.026	235.84	ET	30.00	0.000
	SCHED 40 WET STEEL				120	5.94	0	39.84	0.713
11	8.00	13.00	39.04	23.81	1.25	39.04	0.38808	9.84	6.147
12	0.00	13.00	0.00	29.96	1.380	74.29	T	6.00	0.000
	SCHED 40 WET STEEL				120	15.94	0	15.84	6.147
13	8.00	13.00	39.04	23.81	1.25	39.04	0.38808	9.84	6.147
12	0.00	13.00	0.00	29.96	1.380	74.29	T	6.00	0.000
	SCHED 40 WET STEEL				120	15.94	0	15.84	6.147
14	8.00	13.00	35.25	19.42	1.00	35.25	0.37148	9.84	4.398
13	8.00	13.00	39.04	23.81	1.049	35.25	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.09	0	11.84	4.398



Fire Sprinkler Output Data

Overall Pipe Output Data (cont'd)

Beg. End. Node	Nodal KFactor (K)	Elevation (feet)	Spk/Hose Discharge (gpm)	Residual Pressure (psi)	Nom. Dia. Inside Dia. C-Value	q (gpm) Q (gpm) Velocity (fps)	F. L./ft (psi/ft) Fittings Type-Grp	Pipe-Len. Fit-Len. Tot-Len. (ft)	PF-(psi) PE-(psi) PT-(psi)
15	8.00	13.00	36.04	20.29	1.00	36.04	0.38702	9.84	4.582
16	8.00	13.00	39.90	24.88	1.049	36.04	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.38	0	11.84	4.582
12	0.00	13.00	0.00	29.96	4.00	0.00	0.04417	9.84	1.318
17	0.00	13.00	0.00	31.28	4.026	384.42	T	20.00	0.000
	SCHED 40 WET STEEL				120	9.69	0	29.84	1.318
16	8.00	13.00	39.90	24.88	1.25	39.90	0.40418	9.84	6.402
17	0.00	13.00	0.00	31.28	1.380	75.94	T	6.00	0.000
	SCHED 40 WET STEEL				120	16.29	0	15.84	6.402
18	8.00	13.00	39.90	24.88	1.25	39.90	0.40418	9.84	6.402
17	0.00	13.00	0.00	31.28	1.380	75.94	T	6.00	0.000
	SCHED 40 WET STEEL				120	16.29	0	15.84	6.402
19	8.00	13.00	36.04	20.29	1.00	36.04	0.38702	9.84	4.582
18	8.00	13.00	39.90	24.88	1.049	36.04	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.38	0	11.84	4.582
20	8.00	13.00	37.46	21.92	1.00	37.46	0.41569	9.84	4.922
21	8.00	13.00	41.45	26.85	1.049	37.46	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.91	0	11.84	4.922
17	0.00	13.00	0.00	31.28	4.00	0.00	0.08179	9.84	2.441
22	0.00	13.00	0.00	33.72	4.026	536.30	T	20.00	0.000
	SCHED 40 WET STEEL				120	13.52	0	29.84	2.441
21	8.00	13.00	41.45	26.85	1.25	41.45	0.43391	9.84	6.873
22	0.00	13.00	0.00	33.72	1.380	78.91	T	6.00	0.000
	SCHED 40 WET STEEL				120	16.93	0	15.84	6.873
23	8.00	13.00	41.45	26.85	1.25	41.45	0.43391	9.84	6.873
22	0.00	13.00	0.00	33.72	1.380	78.91	T	6.00	0.000
	SCHED 40 WET STEEL				120	16.93	0	15.84	6.873
24	8.00	13.00	37.46	21.92	1.00	37.46	0.41569	9.84	4.922
23	8.00	13.00	41.45	26.85	1.049	37.46	E	2.00	0.000
	SCHED 40 WET STEEL				120	13.91	0	11.84	4.922
22	0.00	13.00	0.00	33.72	4.00	0.00	0.13182	29.00	7.777
25	0.00	13.00	0.00	41.50	4.026	694.12	ET	30.00	0.000
	SCHED 40 WET STEEL				120	17.49	0	59.00	7.777
25	0.00	13.00	0.00	41.50	4.00	0.00	0.13182	30.50	14.566
26	0.00	13.00	0.00	56.06	4.026	694.12	4T	80.00	0.000
	SCHED 40 WET STEEL				120	17.49	0	110.50	14.566
26	0.00	13.00	0.00	56.06	6.00	0.00	0.01792	58.00	2.419
27	0.00	0.00	0.00	64.11	6.065	694.12	3EGC	77.00	5.629
	SCHED 40 WET STEEL				120	7.71	0	135.00	8.048



Fire Sprinkler Output Data

Overall Sprinkler Output Data

Flowing Sprinkler Node No.	Area Group Code	Sprinkler KFactor (K)	Sprinkler Elevation (feet)	Residual Pressure (psi)	Flowing Area (ft²)	Flowing Density (gpm/ft²)	Sprinkler Discharge (gpm)
1		8.00	13.00	10.56	130.00	0.200	26.00
Sub Totals For Non-Group					130.00	0.200	26.00
2		8.00	13.00	13.07	130.00	0.222	28.92
Sub Totals For Non-Group					130.00	0.222	28.92
4		8.00	13.00	12.83	130.00	0.220	28.65
Sub Totals For Non-Group					130.00	0.220	28.65
5		8.00	13.00	22.09	130.00	0.289	37.60
Sub Totals For Non-Group					130.00	0.289	37.60
6		8.00	13.00	24.75	130.00	0.306	39.80
Sub Totals For Non-Group					130.00	0.306	39.80
8		8.00	13.00	24.19	130.00	0.303	39.35
Sub Totals For Non-Group					130.00	0.303	39.35
9		8.00	13.00	19.73	130.00	0.273	35.53
Sub Totals For Non-Group					130.00	0.273	35.53
10		8.00	13.00	19.42	130.00	0.271	35.25
Sub Totals For Non-Group					130.00	0.271	35.25
11		8.00	13.00	23.81	130.00	0.300	39.04
Sub Totals For Non-Group					130.00	0.300	39.04
13		8.00	13.00	23.81	130.00	0.300	39.04
Sub Totals For Non-Group					130.00	0.300	39.04
14		8.00	13.00	19.42	130.00	0.271	35.25
Sub Totals For Non-Group					130.00	0.271	35.25
15		8.00	13.00	20.29	130.00	0.277	36.04
Sub Totals For Non-Group					130.00	0.277	36.04
16		8.00	13.00	24.88	130.00	0.307	39.90
Sub Totals For Non-Group					130.00	0.307	39.90
18		8.00	13.00	24.88	130.00	0.307	39.90
Sub Totals For Non-Group					130.00	0.307	39.90
19		8.00	13.00	20.29	130.00	0.277	36.04
Sub Totals For Non-Group					130.00	0.277	36.04
20		8.00	13.00	21.92	130.00	0.288	37.46
Sub Totals For Non-Group					130.00	0.288	37.46
21		8.00	13.00	26.85	130.00	0.319	41.45
Sub Totals For Non-Group					130.00	0.319	41.45
23		8.00	13.00	26.85	130.00	0.319	41.45
Sub Totals For Non-Group					130.00	0.319	41.45
24		8.00	13.00	21.92	130.00	0.288	37.46
Sub Totals For Non-Group					130.00	0.288	37.46



Fire Sprinkler Output Data

Overall Sprinkler Output Data (cont'd)

Flowing Sprinkler Node No.	Area Group Code	Sprinkler KFactor (K)	Sprinkler Elevation (feet)	Residual Pressure (psi)	Flowing Area (ft²)	Flowing Density (gpm/ft²)	Sprinkler Discharge (gpm)
Totals For All Groups					2470.00	0.281	694.12



Fire Sprinkler Output Summary

Hydraulically Most Demanding Sprinkler Node

HMD Sprinkler Node Number:	1
HMD Actual Residual Pressure:	10.56 psi
HMD Actual Flow:	26.00 gpm

Sprinkler Summary

Sprinkler System Type:	Wet
Specified Area Of Application:	2500.00 ft ²
Minimum Desired Density:	0.200 gpm/ft ²
Application Average Density:	0.278 gpm/ft ²
Application Average Area Per Sprinkler:	131.58 ft ²
Sprinkler Flow:	694.12 gpm
Average Sprinkler Flow:	36.53 gpm

Flow Velocity And Imbalance Summary

Maximum Flow Velocity (In Pipe 22 - 25)	17.49 ft/sec
Maximum Velocity Pressure (In Pipe 22 - 25)	2.06 psi
Allowable Maximum Nodal Pressure Imbalance:	0.0000 psi
Actual Maximum Nodal Pressure Imbalance:	0.0000 psi
Actual Average Nodal Pressure Imbalance:	0.0000 psi
Actual Maximum Nodal Flow Imbalance:	0.0000 gpm
Actual Average Nodal Flow Imbalance:	0.0000 gpm

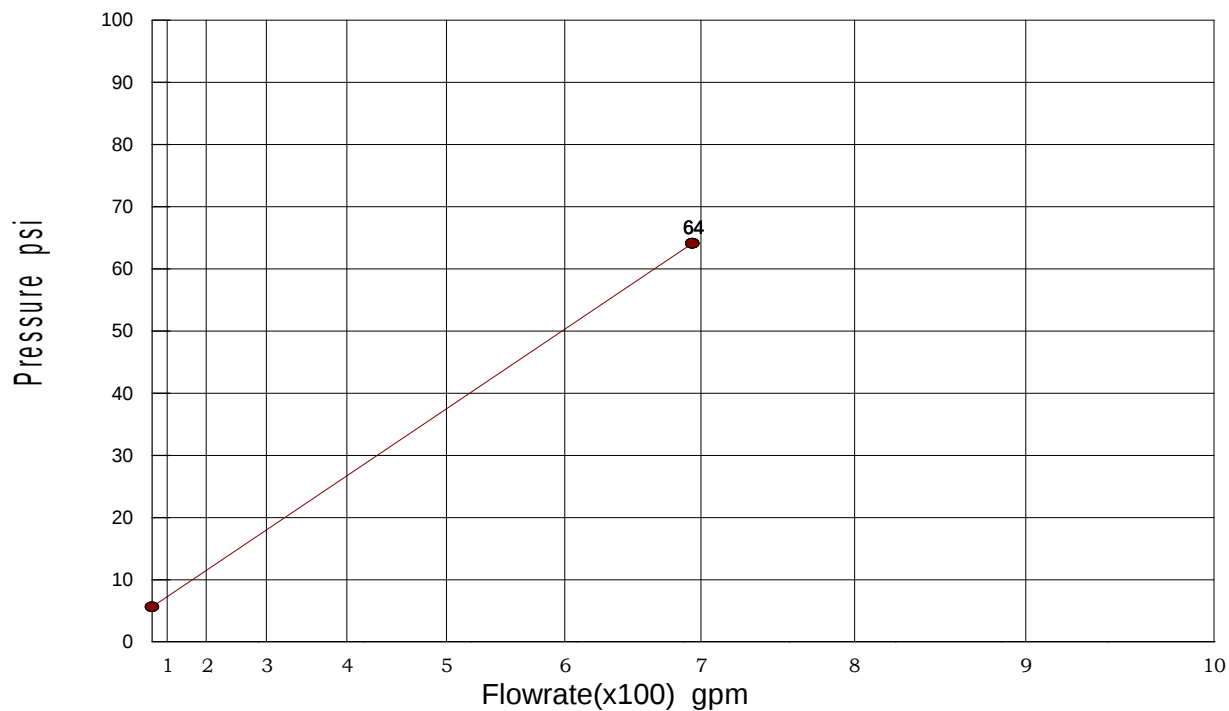
Overall Network Summary

Number Of Unique Pipe Sections:	26
Number Of Flowing Sprinklers:	19
Pipe System Water Volume:	161.15 gal
Sprinkler Flow:	694.12 gpm
Non-Sprinkler Flow:	0.00 gpm
Minimum Required Residual Pressure At System Inflow Node:	64.11 psi
Demand Flow At System Inflow Node:	694.12 gpm



Fire Sprinkler Output Data

Hydraulic Supply/Demand Graph



Demand Curve Data

Calculated Residual Pressure: 64.11 psi

Calculated Flow Rate: 694.12 gpm

Pressure Required For First Sprinkler Downstream From Inflow Node To Flow: 5.63 psi

[illegible]

TCF - C4 FACILITY - ZONE 3

Fire Sprinkler Reports

for

US Army
Camp Buehring, Kuwait

Prepared By:

Engr. Kamal Ram
NBTC
Ahmadi, Kuwait

13/02/2021



General Project Data Report

General Data

Project Title:	TCF - C4 Facility - Zone 3	Project File Name:	TCF - C4 Facility Camp Buehring Kuwait Zone Z-3..fiw
Designed By:	Engr. Kamal Ram	Date:	13/02/2021
Code Reference:	NFPA 13, UFC 3-600-01	Approving Agency:	US Army
Client Name:	US Army	Phone:	
Address:	Camp Buehring, Kuwait	City, State Zip Code:	
Company Name:	NBTC	Representative:	
Company Address:	Ahmadi, Kuwait	City And State:	
Phone:			
Building Name:	TCF - C4 Facility	Building Owner:	US Army
Contact at Building:		Phone at Building:	
Address Of Building:		City, State Zip Code:	

Project Data

Description Of Hazard:	Ordinary 1	Sprinkler System Type:	Wet
Design Area Of Water Application:	2500 ft ²	Maximum Area Per Sprinkler:	130 ft ²
Default Sprinkler K-Factor:	8.00 K	Default Pipe Material:	SCHED 40 WET STEEL
Inside Hose Stream Allowance:	0.00 gpm	Outside Hose Stream Allowance:	0.00 gpm
In Rack Sprinkler Allowance:	0.00 gpm		

Sprinkler Specifications

Make:	Model:	
Size:	Temperature Rating:	0 F

Water Supply Test Data

Source Of Information:		Date Of Test:	
Test Hydrant ID:			
Hydrant Elevation:	0 ft	Static Pressure:	0.00 psi
Test Flow Rate:	0.00 gpm	Test Residual Pressure:	0.00 psi
Calculated System Flow Rate:	440.53 gpm	Calculated Inflow Residual Pressure:	64.16 psi

Calculation Project Data

Calculation Mode:	Demand		
HMD Minimum Residual Pressure:	10.56 psi	Minimum Desired Flow Density:	0.20 gpm/ft ²
Number Of Active Nodes:	17		
Number Of Active Pipes:	16	Number Of Inactive Pipes:	0
Number Of Active Sprinklers:	13	Number Of Inactive Sprinklers:	0



Fire Sprinkler Input Data

Node Input Data

Node No.	Node Description Branch Description	Area Group Branch Dia. (in)	Sprinkler KFactor (K) Branch Len. (ft)	Pressure Estimate (psi) Branch Stnd Fittings	Node Elev (ft) Branch Non- Stnd Fittings (ft)	Non-Sprinkler Flow (gpm) Branch Sprk KFactor (K)
1	Sprinkler ----	---- 0.000	8.00 0.0	10.71 ----	13.00 0.0	0.00 0.00
2	Sprinkler ----	---- 0.000	8.00 0.0	13.25 ----	13.00 0.0	0.00 0.00
3	Sprinkler ----	---- 0.000	8.00 0.0	16.81 ----	13.00 0.0	0.00 0.00
4	Sprinkler ----	---- 0.000	8.00 0.0	25.23 ----	13.00 0.0	0.00 0.00
5	Sprinkler ----	---- 0.000	8.00 0.0	12.69 ----	13.00 0.0	0.00 0.00
6	Sprinkler ----	---- 0.000	8.00 0.0	16.41 ----	13.00 0.0	0.00 0.00
7	Sprinkler ----	---- 0.000	8.00 0.0	20.67 ----	13.00 0.0	0.00 0.00
8	Sprinkler ----	---- 0.000	8.00 0.0	30.79 ----	13.00 0.0	0.00 0.00
9	No Discharge ----	---- 0.000	N/A 0.0	39.16 ----	13.00 0.0	0.00 0.00
10	Sprinkler ----	---- 0.000	8.00 0.0	10.56 ----	13.00 0.0	0.00 0.00
11	Sprinkler ----	---- 0.000	8.00 0.0	13.07 ----	13.00 0.0	0.00 0.00
12	Sprinkler ----	---- 0.000	8.00 0.0	15.92 ----	13.00 0.0	0.00 0.00
13	Sprinkler ----	---- 0.000	8.00 0.0	24.12 ----	13.00 0.0	0.00 0.00
14	Sprinkler ----	---- 0.000	8.00 0.0	30.87 ----	13.00 0.0	0.00 0.00
15	No Discharge ----	---- 0.000	N/A 0.0	46.08 ----	13.00 0.0	0.00 0.00
16	No Discharge ----	---- 0.000	N/A 0.0	57.40 ----	13.00 0.0	0.00 0.00
17	No Discharge ----	---- 0.000	N/A 0.0	64.16 ----	0.00 0.0	0.00 0.00



Fire Sprinkler Input Data

Pipe Input Data

Beg. Node	End. Node	Pipe Description	Nominal Diameter (inch)	Type Group	Fitting Data	Nominal Length (feet)	Fitting Length (feet)	Total Length (feet)	CFactor (gpm/inch-psi)
1	2	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
2	3	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
3	4	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
4	9	SCHED 40 WET STEEL	1.500	0	T	19.68	8.00	27.68	120
5	6	SCHED 40 WET STEEL	1.000	0	T	9.84	5.00	14.84	120
6	7	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
8	9	SCHED 40 WET STEEL	1.500	0	E	9.84	4.00	13.84	120
10	11	SCHED 40 WET STEEL	1.000	0	E	9.84	2.00	11.84	120
11	12	SCHED 40 WET STEEL	1.250	0	E	9.84	3.00	12.84	120
12	13	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120
13	14	SCHED 40 WET STEEL	1.500	0	E	9.84	4.00	13.84	120
14	15	SCHED 40 WET STEEL	1.500	0	T	9.84	8.00	17.84	120
9	15	SCHED 40 WET STEEL	2.500	0	ET	9.84	18.00	27.84	120
15	16	SCHED 40 WET STEEL	3.000	0	E	46.00	7.00	53.00	120
16	17	SCHED 40 WET STEEL	6.000	0	4EGC	56.00	91.00	147.00	120
7	8	SCHED 40 WET STEEL	1.250	0	T	9.84	6.00	15.84	120



Fire Sprinkler Output Data

Overall Node Groupings Output Data

Pipe Segment Beg. Node	End. Node	Pipe Type Group	Pipe Flow Rate (gpm)	Sprinkler Flow At Beg. Node (gpm)	Non-Sprinkler Flow Out (+) (gpm)	In (-) (gpm)	Beg. Node Residual Pressure (psi)	Imbalance Flow At Beg. Node (gpm)
1	2	0	-26.18	26.18	0.00	0.00	10.71	
2	1	0	26.18	29.12	0.00	0.00	13.25	0.00000
2	3	0	-55.30					
3	2	0	55.30	32.80	0.00	0.00	16.81	0.00000
3	4	0	-88.10					
4	3	0	88.10	40.19	0.00	0.00	25.23	0.00000
4	9	0	-128.28					
5	6	0	-28.50	28.50	0.00	0.00	12.69	0.00000
6	5	0	28.50	32.41	0.00	0.00	16.41	0.00000
6	7	0	-60.91					
7	6	0	60.91	36.37	0.00	0.00	20.67	0.00000
7	8	0	-97.28					
8	7	0	97.28	44.39	0.00	0.00	30.79	0.00000
8	9	0	-141.68					
9	4	0	128.28	0.00	0.00	0.00	39.16	0.00000
9	8	0	141.68					
9	15	0	-269.96					
10	11	0	-26.00	26.00	0.00	0.00	10.56	0.00000
11	10	0	26.00	28.92	0.00	0.00	13.07	0.00000
11	12	0	-54.92					
12	11	0	54.92	31.92	0.00	0.00	15.92	0.00000
12	13	0	-86.83					
13	12	0	86.83	39.29	0.00	0.00	24.12	0.00000
13	14	0	-126.13					
14	13	0	126.13	44.45	0.00	0.00	30.87	0.00000
14	15	0	-170.57					
15	9	0	269.96	0.00	0.00	0.00	46.08	0.00000
15	14	0	170.57					
15	16	0	-440.53					
16	15	0	440.53	0.00	0.00	0.00	57.40	0.00000
16	17	0	-440.53					
17	16	0	440.53	0.00	0.00	-440.53	64.16	



Fire Sprinkler Output Data

Overall Pipe Output Data

Beg. End. Node	Nodal KFactor (K)	Elevation (feet)	Spk/Hose Discharge (gpm)	Residual Pressure (psi)	Nom. Dia. Inside Dia. C-Value	q (gpm) Q (gpm) Velocity (fps)	F. L./ft (psi/ft) Fittings Type-Grp	Pipe-Len. Fit-Len. Tot-Len. (ft)	PF-(psi) PE-(psi) PT-(psi)
1	8.00	13.00	26.18	10.71	1.00	26.18	0.21426	9.84	2.537
2	8.00	13.00	29.12	13.25	1.049	26.18	E	2.00	0.000
	SCHED 40 WET STEEL				120	9.72	0	11.84	2.537
2	8.00	13.00	29.12	13.25	1.25	29.12	0.22475	9.84	3.560
3	8.00	13.00	32.80	16.81	1.380	55.30	T	6.00	0.000
	SCHED 40 WET STEEL				120	11.86	0	15.84	3.560
3	8.00	13.00	32.80	16.81	1.25	32.80	0.53196	9.84	8.426
4	8.00	13.00	40.19	25.23	1.380	88.10	T	6.00	0.000
	SCHED 40 WET STEEL				120	18.90	0	15.84	8.426
5	8.00	13.00	28.50	12.69	1.00	28.50	0.25071	9.84	3.720
6	8.00	13.00	32.41	16.41	1.049	28.50	T	5.00	0.000
	SCHED 40 WET STEEL				120	10.58	0	14.84	3.720
6	8.00	13.00	32.41	16.41	1.25	32.41	0.26877	9.84	4.257
7	8.00	13.00	36.37	20.67	1.380	60.91	T	6.00	0.000
	SCHED 40 WET STEEL				120	13.07	0	15.84	4.257
7	8.00	13.00	36.37	20.67	1.25	36.37	0.63912	9.84	10.124
8	8.00	13.00	44.39	30.79	1.380	97.28	T	6.00	0.000
	SCHED 40 WET STEEL				120	20.87	0	15.84	10.124
4	8.00	13.00	40.19	25.23	1.50	40.19	0.50328	19.68	13.931
9	0.00	13.00	0.00	39.16	1.610	128.28	T	8.00	0.000
	SCHED 40 WET STEEL				120	20.22	0	27.68	13.931
8	8.00	13.00	44.39	30.79	1.50	44.39	0.60479	9.84	8.370
9	0.00	13.00	0.00	39.16	1.610	141.68	E	4.00	0.000
	SCHED 40 WET STEEL				120	22.33	0	13.84	8.370
10	8.00	13.00	26.00	10.56	1.00	26.00	0.21153	9.84	2.505
11	8.00	13.00	28.92	13.07	1.049	26.00	E	2.00	0.000
	SCHED 40 WET STEEL				120	9.65	0	11.84	2.505
11	8.00	13.00	28.92	13.07	1.25	28.92	0.22190	9.84	2.849
12	8.00	13.00	31.92	15.92	1.380	54.92	E	3.00	0.000
	SCHED 40 WET STEEL				120	11.78	0	12.84	2.849
12	8.00	13.00	31.92	15.92	1.25	31.92	0.51796	9.84	8.204
13	8.00	13.00	39.29	24.12	1.380	86.83	T	6.00	0.000
	SCHED 40 WET STEEL				120	18.63	0	15.84	8.204
13	8.00	13.00	39.29	24.12	1.50	39.29	0.48774	9.84	6.750
14	8.00	13.00	44.45	30.87	1.610	126.13	E	4.00	0.000
	SCHED 40 WET STEEL				120	19.88	0	13.84	6.750
9	0.00	13.00	0.00	39.16	2.50	0.00	0.24849	9.84	6.918
15	0.00	13.00	0.00	46.08	2.469	269.96	ET	18.00	0.000
	SCHED 40 WET STEEL				120	18.09	0	27.84	6.918



Fire Sprinkler Output Data

Overall Pipe Output Data (cont'd)

Beg. End. Node	Nodal KFactor (K)	Elevation (feet)	Spk/Hose Discharge (gpm)	Residual Pressure (psi)	Nom. Dia. Inside Dia. C-Value	q (gpm) Q (gpm) Velocity (fps)	F. L./ft (psi/ft) Fittings Type-Grp	Pipe-Len. Fit-Len. Tot-Len. (ft)	PF-(psi) PE-(psi) PT-(psi)
14	8.00	13.00	44.45	30.87	1.50	44.45	0.85263	9.84	15.211
15	0.00	13.00	0.00	46.08	1.610	170.57	T	8.00	0.000
SCHED 40 WET STEEL					120	26.88	0	17.84	15.211
15	0.00	13.00	0.00	46.08	3.00	0.00	0.21350	46.00	11.315
16	0.00	13.00	0.00	57.40	3.068	440.53	E	7.00	0.000
SCHED 40 WET STEEL					120	19.12	0	53.00	11.315
16	0.00	13.00	0.00	57.40	6.00	0.00	0.00773	56.00	1.136
17	0.00	0.00	0.00	64.16	6.065	440.53	4EGC	91.00	5.629
SCHED 40 WET STEEL					120	4.89	0	147.00	6.765



Fire Sprinkler Output Data

Overall Sprinkler Output Data

Flowing Sprinkler Node No.	Area Group Code	Sprinkler KFactor (K)	Sprinkler Elevation (feet)	Residual Pressure (psi)	Flowing Area (ft²)	Flowing Density (gpm/ft²)	Sprinkler Discharge (gpm)
1		8.00	13.00	10.71	130.00	0.201	26.18
Sub Totals For Non-Group					130.00	0.201	26.18
2		8.00	13.00	13.25	130.00	0.224	29.12
Sub Totals For Non-Group					130.00	0.224	29.12
3		8.00	13.00	16.81	130.00	0.252	32.80
Sub Totals For Non-Group					130.00	0.252	32.80
4		8.00	13.00	25.23	130.00	0.309	40.19
Sub Totals For Non-Group					130.00	0.309	40.19
5		8.00	13.00	12.69	130.00	0.219	28.50
Sub Totals For Non-Group					130.00	0.219	28.50
6		8.00	13.00	16.41	130.00	0.249	32.41
Sub Totals For Non-Group					130.00	0.249	32.41
7		8.00	13.00	20.67	130.00	0.280	36.37
Sub Totals For Non-Group					130.00	0.280	36.37
8		8.00	13.00	30.79	130.00	0.341	44.39
Sub Totals For Non-Group					130.00	0.341	44.39
10		8.00	13.00	10.56	130.00	0.200	26.00
Sub Totals For Non-Group					130.00	0.200	26.00
11		8.00	13.00	13.07	130.00	0.222	28.92
Sub Totals For Non-Group					130.00	0.222	28.92
12		8.00	13.00	15.92	130.00	0.246	31.92
Sub Totals For Non-Group					130.00	0.246	31.92
13		8.00	13.00	24.12	130.00	0.302	39.29
Sub Totals For Non-Group					130.00	0.302	39.29
14		8.00	13.00	30.87	130.00	0.342	44.45
Sub Totals For Non-Group					130.00	0.342	44.45
Totals For All Groups					1690.00	0.261	440.53



Fire Sprinkler Output Summary

Hydraulically Most Demanding Sprinkler Node

HMD Sprinkler Node Number:	10	
HMD Actual Residual Pressure:	10.56	psi
HMD Actual Flow:	26.00	gpm

Sprinkler Summary

Sprinkler System Type:	Wet	
Specified Area Of Application:	2500.00	ft²
Minimum Desired Density:	0.200	gpm/ft²
Application Average Density:	0.176	gpm/ft²
Application Average Area Per Sprinkler:	192.31	ft²
Sprinkler Flow:	440.53	gpm
Average Sprinkler Flow:	33.89	gpm

Flow Velocity And Imbalance Summary

Maximum Flow Velocity (In Pipe 14 - 15)	26.88	ft/sec
Maximum Velocity Pressure (In Pipe 14 - 15)	4.86	psi
Allowable Maximum Nodal Pressure Imbalance:	0.0000	psi
Actual Maximum Nodal Pressure Imbalance:	0.0000	psi
Actual Average Nodal Pressure Imbalance:	0.0000	psi
Actual Maximum Nodal Flow Imbalance:	0.0000	gpm
Actual Average Nodal Flow Imbalance:	0.0000	gpm

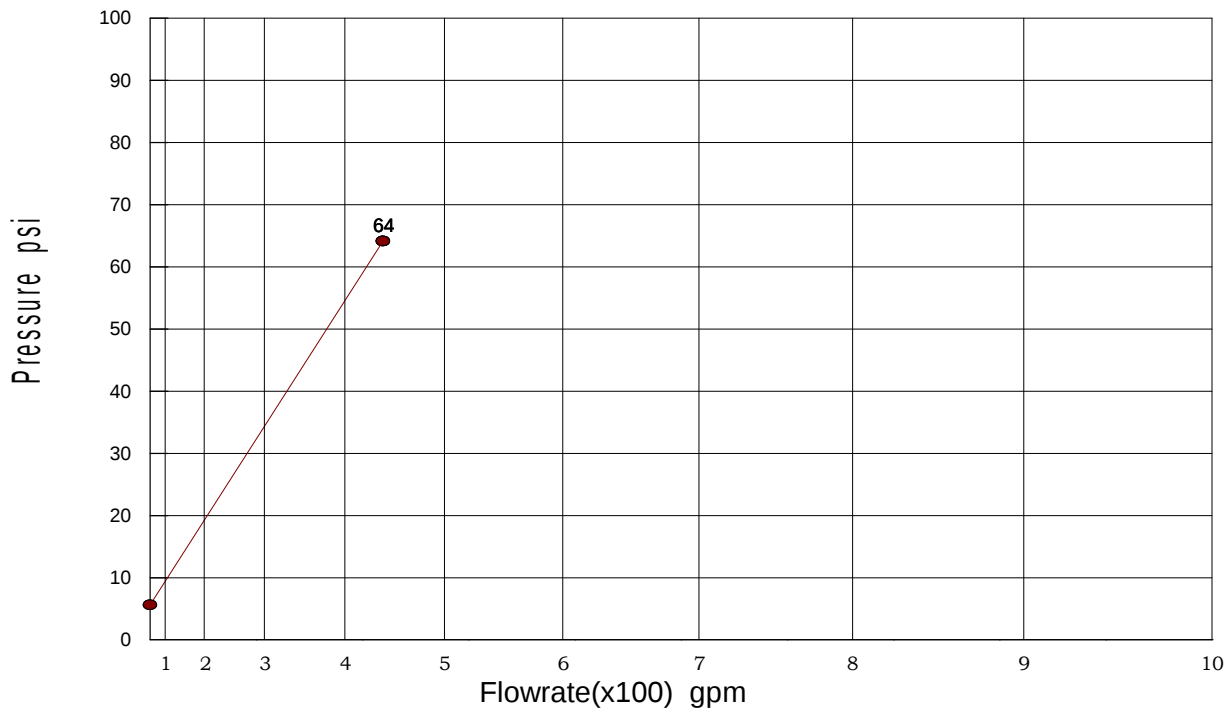
Overall Network Summary

Number Of Unique Pipe Sections:	16	
Number Of Flowing Sprinklers:	13	
Pipe System Water Volume:	115.27	gal
Sprinkler Flow:	440.53	gpm
Non-Sprinkler Flow:	0.00	gpm
Minimum Required Residual Pressure At System Inflow Node:	64.16	psi
Demand Flow At System Inflow Node:	440.53	gpm



Fire Sprinkler Output Data

Hydraulic Supply/Demand Graph

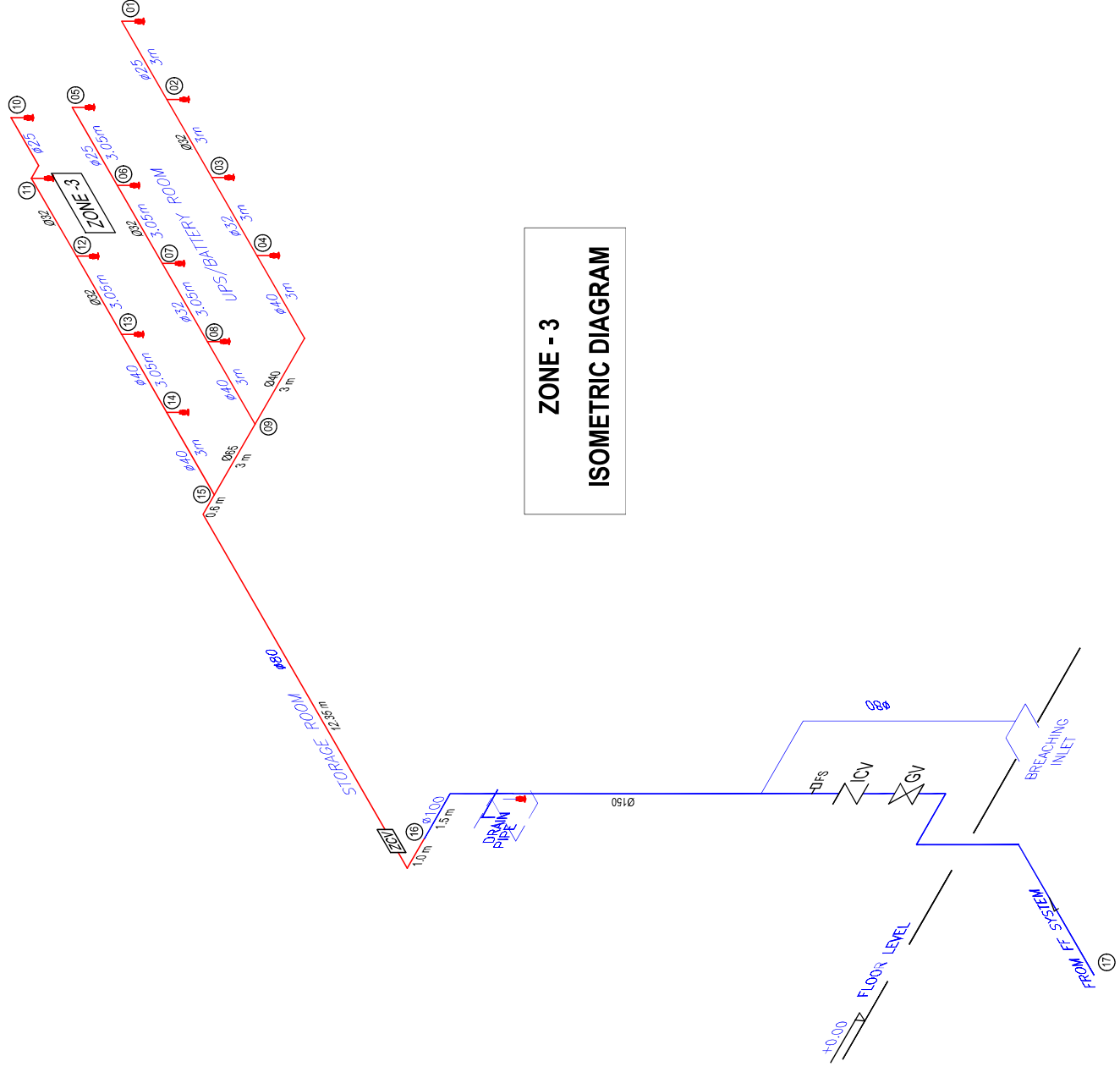


Demand Curve Data

Calculated Residual Pressure: 64.16 psi

Calculated Flow Rate: 440.53 gpm

Pressure Required For First Sprinkler Downstream From Inflow Node To Flow: 5.63 psi

[illegible]