

DESIGN DETAILS
FOR CONDITIONS 1 & 2 (C-1 & C-2)

FRICITION HEAD LOSS IN GATED PIPE - FT. / 100	1.7
FRICITION HEAD LOSS IN ALFALFA VALVE AND OTHER MISCELLANEOUS - FT. / 100	1.3
HEAD REQUIRED TO OPERATE GATED PIPE - FT. / 100	1.0
TOTAL HEAD REQUIRED (ABOVE FIELD) - FT.	4.0
FRICITION HEAD LOSS IN 12" CONCRETE PIPE - FT. PER 100 FT. / 100	0.9
FRICITION HEAD LOSS IN 10" CONCRETE PIPE - FT. PER 100 FT. / 100	2.37

1/ COMPUTATIONS MADE IN ACCORDANCE WITH CRITERIA AS LISTED UNDER "DESIGN CRITERIA AND REFERENCES".

GENERAL NOTES

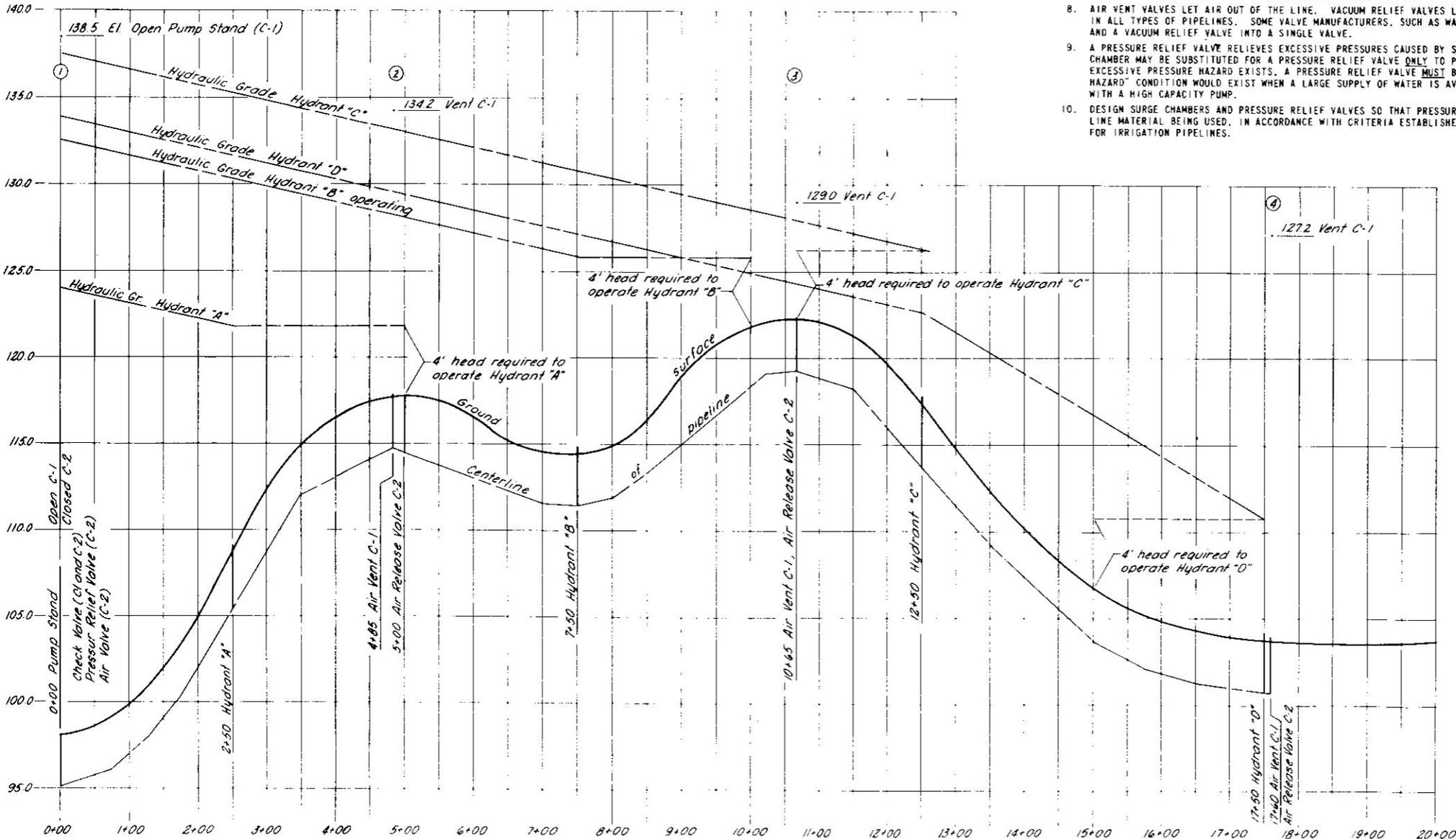
- THIS EXAMPLE ALONG WITH EXAMPLE NOS. 1 & 2, COMPLEMENT AS "SUPPLEMENT A" THE DESIGN CRITERIA AS SHOWN IN NEBRASKA ENGINEERING STANDARDS AND SPECIFICATIONS FOR IRRIGATION PIPELINES.
- THE PROFILE SHOWN ON THIS EXAMPLE HAS BEEN USED TO ILLUSTRATE ONE EXTREME CONDITION IN TOPOGRAPHY. THE SAME PROCEDURE MAY BE USED WHERE PIPELINE IS TO BE LAID ON LESS SEVERE GRADES.
- THIS EXAMPLE IS USED TO ILLUSTRATE SOME OF THE HYDRAULIC PRINCIPLES PERTINENT TO PIPELINE DESIGN. TO SIMPLIFY THIS EXAMPLE, DETAILS OF THE OVERALL IRRIGATION PLAN HAVE, NECESSARILY, BEEN OMITTED. THEREFORE, IT SHOULD NOT BE ASSUMED THAT FEATURES OTHER THAN THOSE DEALING WITH HYDRAULIC PRINCIPLES HAVE BEEN IGNORED OR THAT THESE FEATURES HAVE BEEN GIVEN APPROVAL, EVEN THOUGH THE EXAMPLE, AS SHOWN, MAY SO IMPLY.
- IT IS ASSUMED THAT GATED PIPE APPROXIMATELY PARALLELS PIPELINE. THAT IRRIGATION IS "AWAY FROM" PIPELINE AND THAT NO POINT ON THE GATED PIPE WILL BE HIGHER THAN EXISTING GROUND ON PROFILE AT STATIONS 5+00, 10+00, 10+55 AND 15+00 WHEN HYDRANTS A, B, C AND D RESPECTIVELY ARE OPERATING. SHOULD THE IRRIGATION PLAN AS DEVELOPED REQUIRE THE TRANSPORTING OF WATER TO A POINT TRANSVERSELY FROM THE PIPELINE, ADDITIONAL PROFILE OF THIS PROPOSED LINE, AND OF THE PROPOSED GATED PIPE IT WOULD SERVE, WOULD BE REQUIRED FOR DESIGN.
- THE PUMP DISCHARGE OF 4 CFS WAS CHOSEN AS A NEAR MAXIMUM, MERELY FOR COMPUTATION PURPOSES. A LESSER DISCHARGE RATE COULD HAVE BEEN USED.

APPURTENANCES

CONDITION	PUMP STAND				CHECK VALVE	OPEN AIR VENTS				AIR RELEASE VALVES			PRESSURE RELIEF VALVES
	OPEN		CLOSED			LOCATION	ELEVATION	LOCATION	ELEVATION	LOCATION			LOCATION
	LOCATION	ELEVATION	LOCATION	ELEVATION						POINT ②	POINT ③	POINT ④	POINT ①
C-1	POINT ① STA. 0+00	138.5	NONE	NONE	STA. 0+02 (APPROX.)	POINT ② STA. 4+85	134.2	POINT ③ STA. 10+65	129.0	NONE	NONE	NONE	NONE
C-2	NONE	NONE	POINT ① STA. 0+00	STA. 0+02 (APPROX.)	NONE	NONE	NONE	NONE	NONE	POINT ② STA. 4+85	POINT ③ STA. 10+65	POINT ④ STA. 17+60	POINT ① STA. 0+01 (APPROX.)

DESIGN CRITERIA AND REFERENCES

- HYDRANT SPACING SHOULD BE BASED ON PROPER FURROW STREAMS NEEDED FOR THE IRRIGATION OF PLANNED CROPS AND ON ROW SPACING. ASSUMING A 40" ROW SPACING AND A 24 GPM INITIAL FURROW STREAM, THE PROPER APPLICATION WOULD BE TO APPLY WATER TO ALTERNATE ROWS. OPENINGS THEN WOULD BE USED AT 80" SPACING. THE NUMBER OF ROWS THAT CAN BE IRRIGATED AT ONE TIME WILL BE 1800 GPM ÷ 24 = 76 (APPROX.). 76 ROWS AT 80" SPACING = 507 FT. THEREFORE HYDRANTS CAN BE USED EACH 500', WITH GATED PIPE, CARRYING 900 GPM PLACED 250' EACH WAY FROM HYDRANT.
- THE PIPE SIZE WAS REDUCED TO 10" BETWEEN STA. 12+50 AND 17+50 TO HOLD HYDRAULIC GRADIENT ABOVE PIPELINE.
- FRICITION HEAD LOSSES IN GATED PIPE MAY BE COMPUTED USING FRICITION LOSSES FOR PLAIN ALUMINUM PIPE REDUCED FOR THAT PORTION OF PIPE WITH OPEN OUTLETS. IN THIS EXAMPLE THE FRICITION HEAD LOSS IN 250' OF PLAIN PIPE (WITHOUT OPENINGS) CARRYING 900 GPM IS 1.89 x 2.5 = 4.73 FT. [SEE MEH SECTION 15, CHAPTER 11, TABLE 11-7]. THE FRICITION HEAD LOSS FACTOR FOR 38 OPENINGS (THE NUMBER OF OPEN GATES CONCURRENTLY USED IN 250' OF GATED PIPE) IS 0.36. [SEE TABLE 11-4] THEREFORE THE FRICITION HEAD LOSS IN 250' OF GATED PIPE IS 4.73 x .36 = 1.7' FT. THIS 1.7' OF HEAD IS EQUIVALENT TO 1.7 x 1.483 = 0.74 LBS. PER SQ. IN. OF PRESSURE.
- FRICITION HEAD LOSSES FOR ALFALFA VALVES AND BENDS AND FOR VELOCITY HEAD MAY BE COMPUTED IN ACCORDANCE WITH NEH SECTION 15, CHAPTER 11, PAGES 11-69 THROUGH 11-73.
- THE HEAD REQUIRED TO OPERATE GATED PIPE SHALL BE CONSIDERED TO BE A MINIMUM OF 1.0 FT.
- FRICITION HEAD LOSSES IN PIPELINES MAY BE OBTAINED FROM APPROPRIATE TABLES OR COMPUTED USING FORMULAE AS SHOWN UNDER "FRICITION LOSS" IN THE ENGINEERING STANDARDS AND SPECIFICATIONS FOR IRRIGATION PIPELINES.
- THE HEIGHT OF OPEN AIR VENTS SHALL PROVIDE THE REQUIRED FREEBOARD ABOVE THE HIGHEST HYDRAULIC GRADE LINE OBTAINABLE WITH THE SYSTEM. THIS IS GENERALLY OBTAINED WHEN THE HIGHEST HYDRANT IN THE LINE IS OPERATING.
- AIR VENT VALVES LET AIR OUT OF THE LINE. VACUUM RELIEF VALVES LET AIR INTO THE LINE. AIR VENT VALVES MAY BE USED IN ALL TYPES OF PIPELINES. SOME VALVE MANUFACTURERS, SUCH AS WATERMAN, COMBINE FEATURES OF BOTH AN AIR VENT VALVE AND A VACUUM RELIEF VALVE INTO A SINGLE VALVE.
- A PRESSURE RELIEF VALVE RELIEVES EXCESSIVE PRESSURES CAUSED BY SURGE, WATER HAMMER AND IMPROPER OPERATION. A SURGE CHAMBER MAY BE SUBSTITUTED FOR A PRESSURE RELIEF VALVE ONLY TO PROTECT AGAINST SURGE AND WATER HAMMER. WHEN AN EXCESSIVE PRESSURE HAZARD EXISTS, A PRESSURE RELIEF VALVE MUST BE USED. AS AN EXAMPLE, AS "EXCESSIVE PRESSURE HAZARD" CONDITION WOULD EXIST WHEN A LARGE SUPPLY OF WATER IS AVAILABLE AND A LARGE UNGOVERNED POWER PLANT IS USED WITH A HIGH CAPACITY PUMP.
- DESIGN SURGE CHAMBERS AND PRESSURE RELIEF VALVES SO THAT PRESSURES DO NOT EXCEED THAT ALLOWED FOR THE SPECIFIC PIPELINE MATERIAL BEING USED, IN ACCORDANCE WITH CRITERIA ESTABLISHED IN THE ENGINEERING STANDARDS AND SPECIFICATIONS FOR IRRIGATION PIPELINES.



SUPPLEMENT A
NEBRASKA ENGINEERING STANDARD AND
SPECIFICATIONS FOR IRRIGATION PIPELINE
EXAMPLE 3

IRRIGATION PIPELINE DESIGN
12" / 10" CONC. PIPE W/RUBBER GASKETS., PUMP DISCHARGE = 4 CFS.,
HYDRANT SPACING - 500 FT. W/250 FT. GATED PIPE EACH WAY.
2 CONDITIONS (C-1 AND C-2) - USING DIFFERENT
APPURTENANCES AS SHOWN.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	C.W.	Date	8-66	Approved by	
Drawn	LES	Title	12-66	Title	
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