

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

FRICITION HEAD LOSS IN GATED PIPE - FT. 1/	1.7
FRICITION HEAD LOSS IN ALFALFA VALVE AND OTHER MISCELLANEOUS - FT. 1/	1.3
HEAD REQUIRED TO OPERATE GATED PIPE - FT. 1/	1.0
TOTAL HEAD REQUIRED (ABOVE FIELD) - FT.	4.0
FRICITION HEAD LOSS IN 12" CONCRETE PIPELINE, FT. PER 100 FT. 1/	0.9

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

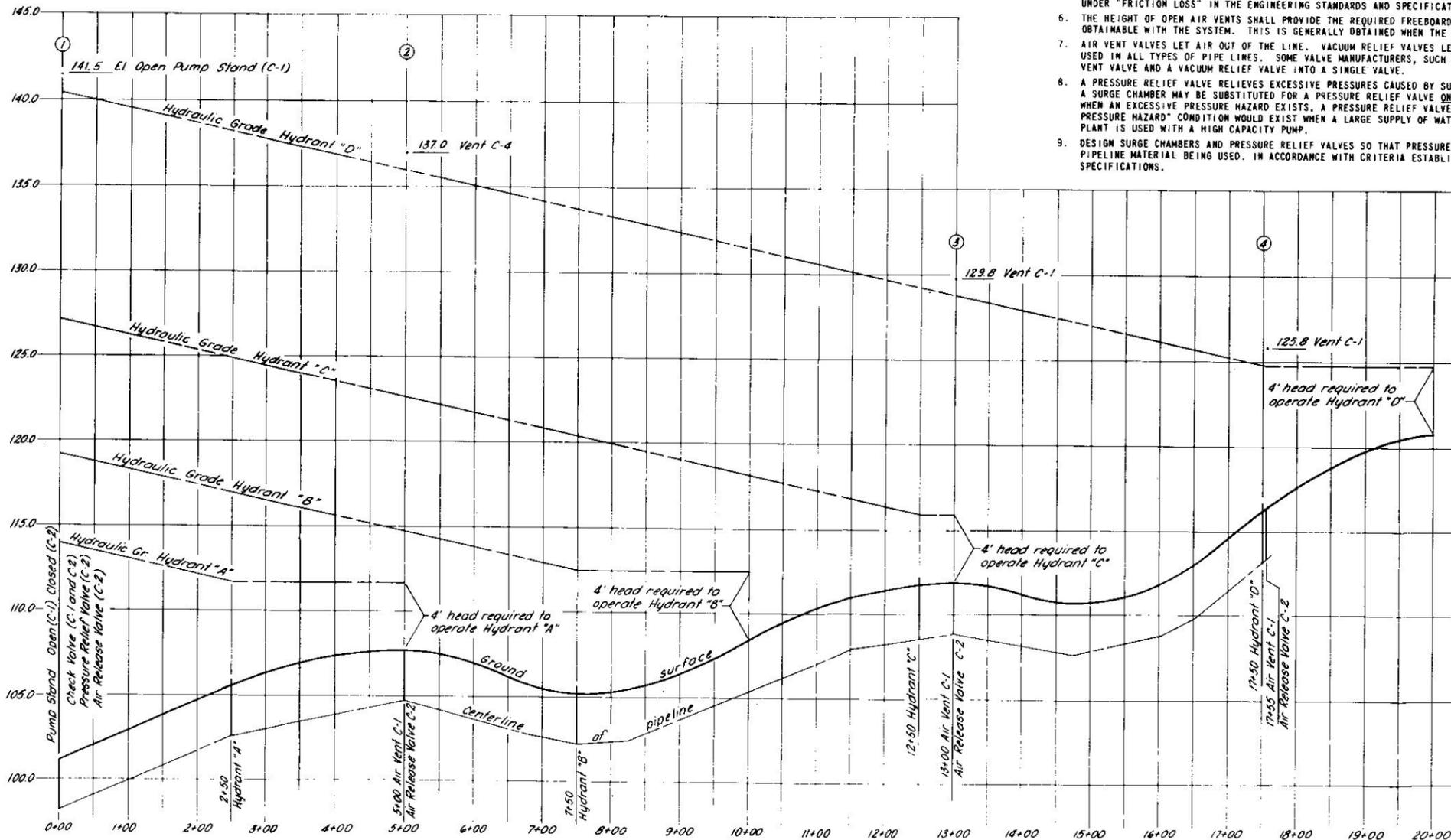
GENERAL NOTES

- THIS EXAMPLE ALONG WITH EXAMPLES NOS. 1 AND 3, 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 THE 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 GATED PIPE WILL BE HIGHER THAN EXISTING GROUND ON PROFILE AT STATIONS 5+00, 10+00, 13+00 AND 20+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 LOCATION OF THE 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.

CONDITION	PUMP STAND		CHECK VALVES	APPURTENANCES			AIR RELEASE VALVES	PRESSURE RELIEF VALVES
	OPEN	CLOSED		OPEN AIR VENTS	AIR RELEASE VALVES	PRESSURE RELIEF VALVES		
	LOCATION	ELEVATION	LOCATION	LOCATION	ELEVATION	LOCATION	LOCATION	LOCATION
C-1	POINT ① STA. 0+00	141.5	NONE	STA. 0+02 (APPROX.)	POINT ② STA. 5+00 POINT ④ STA. 17+55	POINT ③ STA. 13+00 POINT ④ STA. 17+55	NONE	NONE
C-2	NONE		POINT ① STA. 0+00	STA. 0+02 (APPROX.)	NONE		POINT ① STA. 0+01 POINT ② STA. 5+00 POINT ③ STA. 13+00 POINT ④ STA. 17+55	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 = 75 (APPROX.), 76 ROWS AT 80" SPACING = 507 FT. THUS, HYDRANTS CAN BE USED EACH 500 FT. WITH GATED PIPE, CARRYING 900 GPM PLACED 250 FT. EACH WAY FROM HYDRANT.
- FRICITION HEAD LOSSES IN GATED PIPE MAY BE COMPUTED USING FRICTION LOSSES FOR PLAIN ALUMINUM PIPE REDUCED FOR THAT PORTION OF PIPE WITH OPEN OUTLETS. IN THIS EXAMPLE, THE FRICTION HEAD LOSS IN 250 FT. OF PLAIN ALUMINUM PIPE (WITHOUT OPENINGS) CARRYING 900 GPM IS 1.89 X 2.5 = 4.73 FT. (SEE NEH SECTION 15, CHAPTER 11, TABLE 11-7). THE FRICTION HEAD LOSS FACTOR FOR 38 OPENINGS (THE NUMBER OF OPEN GATES CONCURRENTLY USED IN 250 FT. OF GATED PIPE) IS 0.36. (SEE TABLE 11-4). THEREFORE THE FRICTION HEAD LOSS IN 250 FT. OF GATED PIPE IS 4.73 X 0.36 = 1.7 FT. THIS 1.7 FT. OF HEAD IS EQUIVALENT TO 1.7 X .433 = 0.74 LBS. PER SQ. IN. OF PRESSURE. THIS PRESSURE AT THE HYDRANT WILL OVERCOME FRICTION LOSSES IN THE TWO 250 FT. LENGTHS OF GATED PIPE.
- FRICTION 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.
- FRICTION HEAD LOSSES IN PIPELINES MAY BE OBTAINED FROM APPROPRIATE TABLES OR COMPUTED USING FORMULAE AS SHOWN UNDER "FRICTION 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 PIPE LINES. 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, AN "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 STANDARD AND SPECIFICATIONS.



SUPPLEMENT A  
NEBRASKA ENGINEERING STANDARD AND  
SPECIFICATIONS FOR IRRIGATION PIPELINE  
EXAMPLE 2

**IRRIGATION PIPELINE DESIGN**  
12" CONCRETE PIPE W/RUBBER GASKETS., PUMP DISCHARGE = 4 CFS.,  
HYDRANT SPACING - 500 FT. W/250 FT. 8" 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 <i>G.W.</i>	Date <i>8-66</i>	Approved by _____
Drawn <i>L.E.S.</i>	Title <i>12-66</i>	_____
Traced _____	Sheet _____	_____
Checked _____	No. <i>2</i>	_____
	of <i>3</i>	_____