

990	J	AB-036094	1 of 2	16
PLANT NO.	INDEX	DRAWING NUMBER	SHT. NO.	REV. NO.

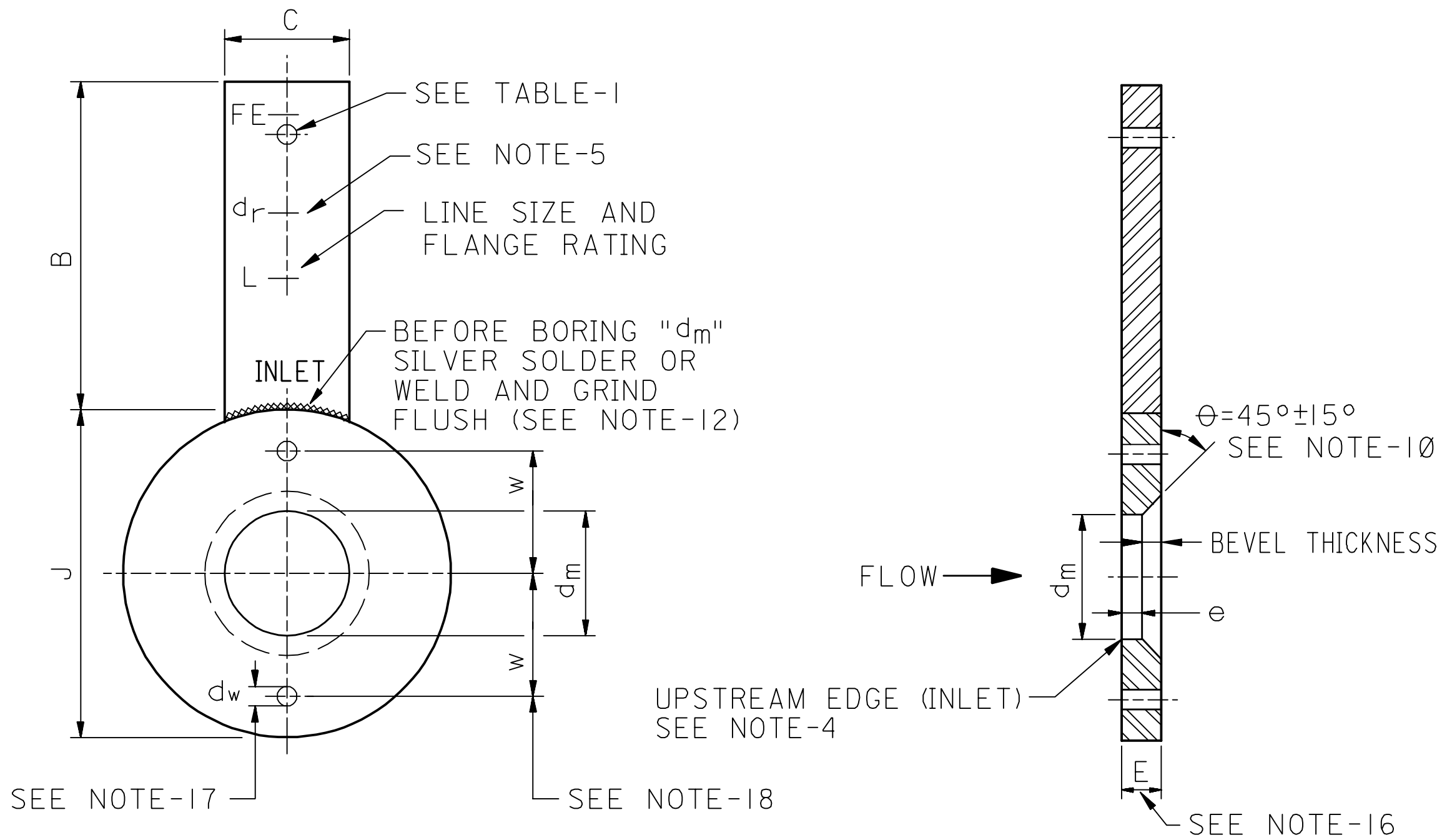
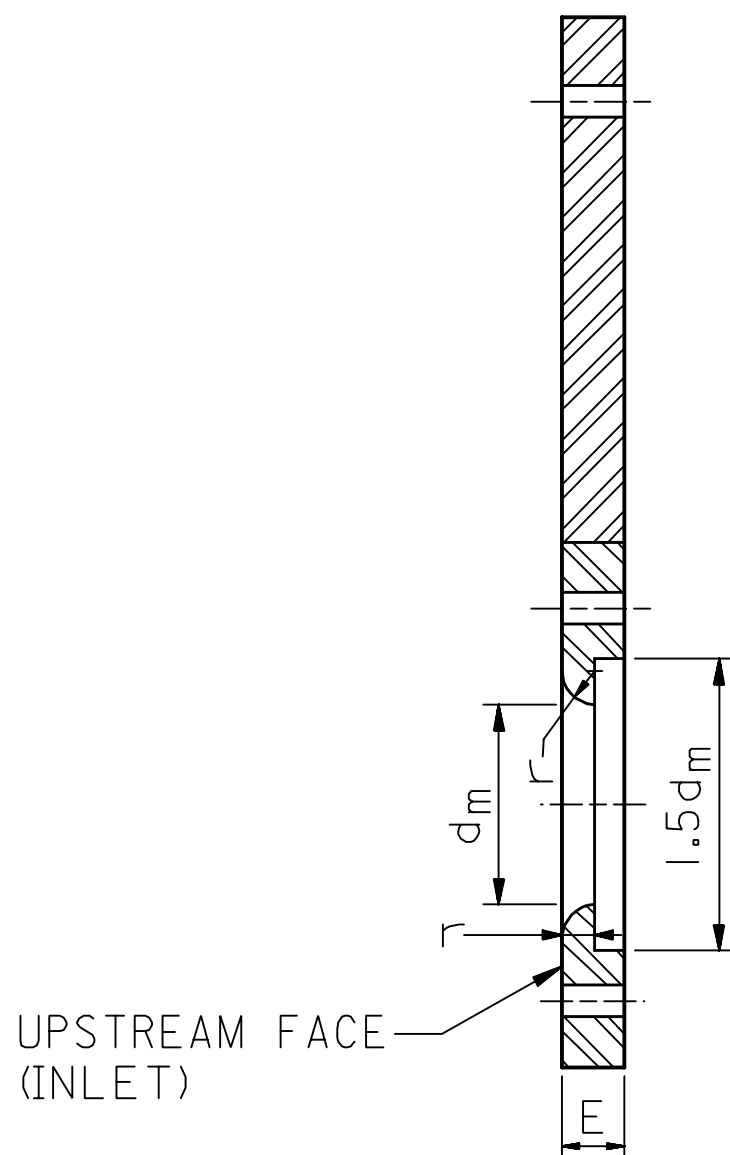


TABLE-1

PLATE SIZE	MIN. HANDLE HOLE DIAMETER
2"	1/4"
3" - 12"	3/8"
14" - 24"	1/2"
≥ 26"	3/4"

MATERIAL: SEE NOTE-1
SURFACE QUALITY: SEE NOTE-3

DETAIL-1A
SQUARE EDGE
REFER FORM 3178



DETAIL-1B
QUADRANT EDGE
REFER FORM 3177

DIMENSIONS (INCHES)								
PIPE SIZE	CLASS 150	CLASS 300	CLASS 600	ALL RATINGS				BEVEL THICKNESS
	J	J	J	B	C	E	e	
2	-	4 3/8	4 3/8	4	1	1/8	1/32	3/32
3	-	5 7/8	5 7/8	4	1 1/4	1/8	1/32	3/32
4	-	7 7/8	7 7/8	4	1 1/4	1/8	1/16	1/16
6	-	9 7/8	10 1/2	5	1 1/2	1/8	1/16	1/16
8	-	12 1/8	12 5/8	5	1 1/2	1/8	1/8	Ø
10	-	14 1/4	15 3/4	6	1 1/2	1/4	3/16	1/16
12	-	16 5/8	18	6	1 1/2	1/4	3/16	1/16
14	17 3/4	19 1/8	19 3/8	6	1 1/2	1/4	1/4	Ø
16	20 1/4	21 1/4	22 1/4	6	1 1/2	3/8	5/16	1/16
18	21 1/2	23 3/8	24	6	1 1/2	3/8	9/16	1/16
20	23 3/4	25 5/8	26 3/4	6	1 1/2	3/8	3/8	Ø
24	28 1/8	30 3/8	31	6	1 1/2	3/8	3/8	Ø
26	30 3/8	32 3/4	34	6	1 1/2	3/8	3/8	Ø
28	32 5/8	35 1/4	35 7/8	6	1 1/2	1/2	1/2	Ø
30	34 5/8	37 3/8	38 1/8	6	1 1/2	1/2	1/2	Ø
32	36 7/8	39 1/2	40 1/8	6	1 1/2	1/2	1/2	Ø
34	38 7/8	41 1/2	42 1/8	6	1 1/2	1/2	1/2	Ø
36	41 1/8	43 7/8	44 3/8	6	1 1/2	1/2	1/2	Ø
38	43 5/8	45 7/8	46 5/8	6	1 1/2	1/2	1/2	Ø
40	45 5/8	48 1/8	48 1/8	6	1 1/2	3/4	3/4	Ø
42	47 7/8	50 3/8	50 7/8	6	1 1/2	3/4	3/4	Ø
44	50 1/8	52 7/8	52 7/8	6	1 1/2	3/4	3/4	Ø
46	52 1/8	55 1/8	55 1/8	6	1 1/2	3/4	3/4	Ø
48	54 3/8	58 3/8	57 3/8	6	1 1/2	3/4	3/4	Ø

TOLERANCES (INCHES)	
J	ORIFICE PLATE OUTSIDE DIAMETER $\pm .015$
B	IDENTIFICATION HANDLE LENGTH $\pm 1/4$
C	IDENTIFICATION HANDLE WIDTH $\pm 1/4$
E	ORIFICE PLATE THICKNESS (NOTE-16)
	LINE SIZES 2" THRU 8" $\begin{matrix} + 0.005 \\ - 0.010 \end{matrix}$
	LINE SIZES $\geq 10"$ $\begin{matrix} + 0.020 \\ - 0.015 \end{matrix}$
d _r	$\pm 0.001"$ OF d _c (SEE NOTES-11, 14)
d _m	ROUNDNESS (SEE NOTE-11)
	$\leq 0.250"$ $\pm 0.0003"$
	0.251" TO 0.375" $\pm 0.0004"$
	0.376" TO 1.000" $\pm 0.0005"$
	OVER 1.000" $\pm 0.0005"$ PER INCH OF d _m
W	DRAIN HOLE LOCATION (NOTE-17) $+1/64, -1/32$
r	THICKNESS AT THROAT-ORIFICE EDGE RADIUS ± 0.015
ORIFICE PLATE FLATNESS; (PER API 14.3.2 TABLE 2-1)	
ORIFICE BORE CONCENTRICITY: WITHIN 2" = 0.0015 WITH RESPECT TO "J" $\begin{matrix} 3-4" = 0.002 \\ 6" = 0.003 \\ 8-16" = 0.005 \\ \geq 18" = 0.010 \end{matrix}$	

- d_m - MEASURED INTERNAL DIAMETER OF THE METER TUBE.
- d_m - ORIFICE PLATE BORE AT T_m
- d_r - ORIFICE PLATE BORE DIAMETER CALCULATED AT REFERENCE TEMPERATURE (T_r) (SEE NOTE-14)
- d_c - CALCULATED ORIFICE BORE AS SPECIFIED ON FORM 3175, 3176 OR 3177
- d_w - DIAMETER OF VENT OR DRAIN HOLE
- T_m - MEASURED TEMPERATURE OF ORIFICE PLATE AND/OR METER TUBE AT THE TIME OF DIAMETER MEASUREMENTS
- T_r - REFERENCE TEMPERATURE OF THE CALCULATED ORIFICE PLATE BORE DIAMETER. FOR SAUDI ARAMCO T_r= 20°C (68°F)
- e - ORIFICE PLATE BORE THICKNESS

DETAIL-1

PADDLE TYPE ORIFICE PLATE FOR
RAISED FACE FLANGES

TABLE-2 DRAIN OR VENT HOLE DIAMETER (INCHES)	
PRIMARY ELEMENT BORE d _m	DIAMETER d _w OF VENT (DRAIN) HOLE
1.000-3.500	3/32
3.501-4.125	1/8
4.126-5.000	5/32
5.001-6.000	3/16
6.001-6.750	7/32
6.751-7.500	1/4
7.501-8.375	9/32
8.376-9.250	5/16
9.251-10.000	11/32
10.001-10.875	3/8
10.876-11.625	13/32
11.626-12.500	7/16
12.501-13.250	15/32
> 13.250	1/2

NOTES (CONTINUATION)

9. FOR ECCENTRIC AND SEGMENTAL PLATES, THIS DRAWING MAY BE USED EXCEPT FOR SHAPE AND/OR LOCATION OF ORIFICE BORE.
10. THE SURFACE OF THE PLATE BEVEL SHALL HAVE NO DEFECTS VISIBLE TO THE NAKED EYE, SUCH AS GROOVES, RIDGES, PITS, OR LUMPS.
11. THE MEASURED ORIFICE BORE DIAMETER, d_m, IS DEFINED AS THE MEAN (ARITHMETIC AVERAGE) OF FOUR OR MORE EVENLY SPACED DIAMETER MEASUREMENTS. NONE OF THE FOUR OR MORE DIAMETER MEASUREMENTS MAY VARY FROM THE MEAN VALUE BY MORE THAN THE TOLERANCES GIVEN IN DETAIL-1.
- THE ORIFICE PLATE TEMPERATURE (T_m) SHOULD BE NOTED AT THE TIME THE BORE DIAMETER MEASUREMENTS ARE MADE.
12. IT IS ALSO ACCEPTABLE FOR THE ORIFICE PLATE AND HANDLE TO BE MANUFACTURED AS ONE PIECE.
13. IT IS ALSO ACCEPTABLE TO TACK WELD THE ORIFICE HOLDER HANDLE TO THE RING GASKET INSTEAD OF DRILL AND TAPPING.
14. THE ORIFICE PLATE BORE DIAMETER, (d_r), IS DEFINED AS THE CALCULATED REFERENCE DIAMETER AT REFERENCE TEMPERATURE (T_r), 68°F, AND CAN BE DETERMINED USING THE FOLLOWING EQUATION.
- d_r = d_m (1 + ∞(T_r - T_m))
- ∞ = LINEAR COEFFICIENT OF THERMAL EXPANSION (IN/IN-°F). FOR COMMON METALS, TYPE 304 AND 316, S.S. ∞ = 9.25 X 10⁻⁶, MONEL ∞ = 7.95 X 10⁻⁶, CARBON STEEL ∞ = 6.20 X 10⁻⁶
15. R-23 DIMENSIONS DO NOT ALLOW MANUFACTURING AS A PLATE HOLDER BECAUSE THE BAND BETWEEN "F" AND RING I.D. IS ONLY 0.184", (NOT ENOUGH SPACE FOR HOLD DOWN SCREWS). RINGS R-23 & R-24 PLATE HOLDER MAY ALTERNATIVELY BE SPECIFIED WITH STEEL SNAP RING TO HOLD ORIFICE IN PLACE.
16. PLATE THICKNESS (E) IS VALID FOR DIFFERENTIAL PRESSURES NOT EXCEEDING 200 INCHES OF WATER COLUMN (150 INCHES WATER COLUMN FOR NON BEVEL 8 INCH PLATES). IN CASE OF NATURAL GAS FLUIDS MEASUREMENTS, PLATE THICKNESS (E) IS VALID FOR OPERATING TEMPERATURE NOT TO EXCEED 150°F AND DIFFERENTIAL PRESSURE NOT EXCEEDING 200 INCHES OF WATER COLUMN. IN ALL OTHER CASES, THE MANUFACTURER SHOULD BE CONTACTED FOR SPECIFIC ORIFICE PLATE THICKNESS (E) AND ITS DEFELECTION TOLERANCE.
17. SEE TABLE-2 FOR DRAIN OR VENT HOLE DIAMETER CONDITIONS FOR INSTALLATION OF DRAIN OR VENT HOLE:
- A. VERTICAL METER RUN - NO HOLE NECESSARY.
- B. CUSTODY METERING OF HYDROCARBON GASES - NO HOLES ALLOWED.
- C. HORIZONTAL METER RUN, WET GAS, SATURATED STEAM, ONE DRAIN HOLE, BOTTOM ORIENTATION.
- D. HORIZONTAL METER RUN, GAS ENTRAINED LIQUID SERVICE, ONE VENT HOLE, TOP ORIENTATION.
18. DIMENSION "W" MAY BE CALCULATED FROM:
W = (D_m - d_w) / 2

NOTES:

1. MATERIAL FOR THE ORIFICE PLATE SHALL BE ASTM A 240 TYPE 316 STAINLESS STEEL, ANNEALED CONDITION WITH MAXIMUM HARDNESS 217 HB UNLESS OTHERWISE SPECIFIED ON THE ORDER. HANDLE AND SCREWS SHALL BE A 300-SERIES STAINLESS STEEL. FOR SEVERELY CORROSIVE SERVICE, OBTAIN A MATERIAL RECOMMENDATION FROM THE CONSULTING SERVICES DEPARTMENT.
2. MATERIAL FOR PLATE HOLDER SHALL BE SOFT IRON OR LOW CARBON STEEL WITH A MAXIMUM HARDNESS OF 120 HB. STAINLESS STEEL ORIFICE PLATE HOLDERS SHOULD BE USED WITH STAINLESS STEEL FLANGES. TO INSURE THEY ARE SOFTER THAN MATING FLANGES, STAINLESS STEEL HOLDERS SHALL HAVE A MAXIMUM HARDNESS OF 150 HB UNLESS OTHERWISE SPECIFIED IN THE ORDER.
3. THE SURFACE QUALITY OF ORIFICE PLATE INLET AND OUTLET FACES SHALL HAVE A SURFACE ROUGHNESS RATING EQUAL TO OR FINER THAN 50 MICRO INCHES (HONE, LAP, POLISH OR BUFF FINISH) AND SHALL BE ENTIRELY FREE FROM SURFACE DEFECTS. THE SURFACE OF THE ORIFICE PLATE HOLDER CONTACTING THE ORIFICE PLATE SHALL HAVE A QUALITY EQUAL TO THAT REQUIRED FOR ORIFICE FACES AS ABOVE.
4. FOR SQUARE EDGE ORIFICE PLATES THE UPSTREAM EDGE OF THE ORIFICE MUST BE SQUARE AND SHARP. WITHOUT DEFECTS OF ANY SORT, SO THAT A BEAM OF LIGHT IS NOT REFLECTED BY THE UPSTREAM EDGE WHEN VIEWED WITHOUT MAGNIFICATION.
5. THE FOLLOWING ITEMS SHALL BE METAL STAMPED ON THE UPSTREAM SIDE OF THE PADDLE TYPE ORIFICE PLATE HANDLE OR RING JOINT IDENTIFICATION HANDLE: EXAMPLE:
- | | |
|----------------------------------|-----------------------|
| TAG | FE-480-100 |
| REFERENCE BORE (d _r) | d _r 2.313" |
| LINE SIZE | 6" |
| ANSI OR API FLANGE RATING | 150# ANSI |
| PLATE MATERIAL | 316 SS |
- FOR UNBORED PLATES:
- | | |
|---------------------------|-----------|
| LINE SIZE | 6" |
| ANSI OR API FLANGE RATING | 3000# API |
| PLATE MATERIAL | 316 SS |
6. "d_c", "W" VENT OR DRAIN HOLE, AND "r" ARE GIVEN ON FORM 3175, 3176 OR 3177.
7. WHEN ORDERING SPECIFY:
FOR RAISED FACE FLANGE INSTALLATION:
A) PIPE SIZE AND SCHEDULE
B) FLANGE RATING
C) EITHER-BLANK OR "d_c", "e", "E", "r", "W" AND DRAIN OR VENT HOLE LOCATION
FOR RING JOINT FLANGE INSTALLATION:
A) PIPE SIZE AND SCHEDULE
B) EITHER RING NUMBER OR FLANGE RATING
C) EITHER BLANK OR "d_c", "e", "E", "r", "W" AND DRAIN OR VENT HOLE LOCATION.
8. THE OUTSIDE ORIFICE PLATE EDGES SHALL BE DE-BURRED.

DWG. RESPONSIBILITY :					
INSTRUMENTS STANDARDS COMMITTEE					
15	MAR99	EDSD WED	ADDED CONDITIONS FOR INSTAL. & RECCOM. MAX. DRAIN OR VENT HOLE		
14	NOV96	RCR	CHGD. MANDATORY DRAWING NOTE TO DRAWING RESPONSIBILITY NOTE.	ORIG. SIGNED	ORIG. SIGNED
13	SEP95	ESSD CAB	GENERAL REVISION AND ADDED NOTE 16.	ORIG. SIGNED	ORIG. SIGNED
16	JAN82	MHJ	REVISED NOTE 16.		
REV. NO.	DATE	BY JO/EWO	DESCRIPTION	CHKD.	CERT. APPD.

SAUDI ARABIAN OIL COMPANY				
DRAWN BY _____		CHECKED BY _____		SCALE _____ NONE
DATE STARTED _____		DATE COMPLETED _____		
OPR'G. DEPT. _____		ENG. DEPT. _____		
APP'D FOR CONSTR. _____				
THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED			CERTIFIED _____ BY _____ DATE _____	
STANDARD ORIFICE PLATES				
STD. DWG.			SAUDI ARABIA	
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