



DESIGN MANUAL
SPD0005EIE
INSTRUMENT DESIGN
RESTRICTION ORIFICE DESIGN

REV. : 0

DATE : 2013.06.20

	ENGINEERING MANUAL RESTRICTION ORIFICE DESIGN	SPD0005E1E
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1. GENERAL

1.1 Purpose

Restriction orifice restricts the flow of fluid by installing the orifice plate between the pipe, and the purpose of this is to drop the pressure or allow the minimum flow rate, and this manual describes how to make decision on the specifications for orifice plate.

1.2 Application Scope

Calculation for restriction orifice shall be done by using the formula of orifice for flow rate measuring. In case of liquid, orifice bore is decided from the flow coefficient which is based on the pipe tap., but for steam and vapor, decision shall be made with consideration of expansion factor and critical pressure drop ($\Delta P \geq P_{1/2}$).

2. DESIGN METHOD

2.1 Orifice Bore Sizing

(Reference : Principles and Practice of Flow Meter Engineering. Written by L.K. Spink)

2.1.1 Liquid

$$(1) S = \frac{Q\sqrt{r_1}}{0.01252D^2\sqrt{\Delta P}}$$

(2) Value β shall be calculated after S is found.

2.1.2 Vapor and Steam

$$(1) \text{ If } \Delta P < \frac{P_1}{2} \text{ then,}$$

$$1) S = \frac{W}{0.01252 Y D^2 \sqrt{r_1 \times \Delta P}}$$

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2) Suppose that $Y = 1$, then find S and the value β

3) Based on the obtained value β and ΔP and K , Y is decided at Appendix II.

4) Apply the obtained Y to the formula to calculate for S , and β is decided based on the obtained value S .

(2) If $P \geq \frac{P_2}{2}$ then,

$$1) \quad Y_{tSp} = \frac{W}{0.2378 D^2 \sqrt{r_1} \sqrt{P_1}}$$

2) After Y_{tSp} is obtained, find value β from Appendix I.

3) If the value exceeds Appendix I, leave $Y_t = 3.2$ and find the value β after S_p is obtained.

$$S_p : \alpha \beta^2$$

Q : Volumetric flow of under design standard (m^3/H)

W : Weight flow (Kg/H)

r_1 : Primary specific gravity (Kg/m^3)

Shall be found at table in case of steam.

$$\text{Is case of vapor, } r_1 = \frac{MP_1}{0.084792ZT}$$

T : Absolute temperature under design standard ($^{\circ}K$)

D : Inside diameter of pipe (mm)

P : Differential pressure (mm H_2O)

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P_1 : Primary pressure (Kg/cm² abs)

Y : Expansion factor

Yt : Expansion factor under critical pressure drop

β : Orifice diameter ratio (d/D)

M : Molecular weight

α : Orifice flow coefficient

χ : $\Delta P/P_1$

Z : Compressibility factor

d : Orifice diameter (mm)

K : Ratio of specific heats

2.2 Orifice Plate Thickness

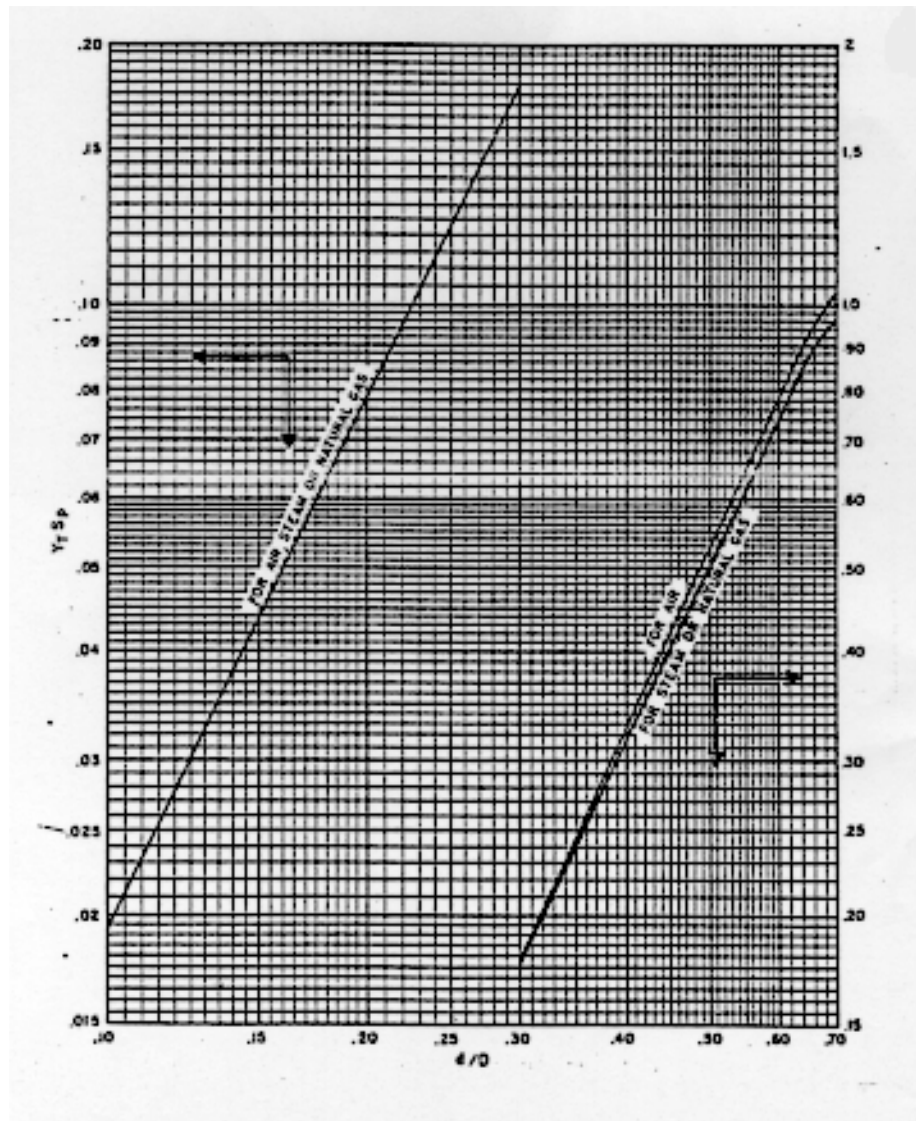
Thickness shall be decided at Appendix III based on the inside diameter and differential pressure of pipe.

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3. HISTORY OF THIS MANUAL

Rev. No.	Date of Rev.	Rev. page	Basis of revision
0	JUN. 20, 2013	Whole pages	- Establish environmental design criteria in accordance with SECL standard manual - Department : Environmental Engineering Dept. - Written by : Y.J.Yoon - Checked by : S.K.Kang - Approved by : Y.Y.Koo

Appendix I: $Y_1 Sp$ for Throttling Orifices at Critical Pressure Drop



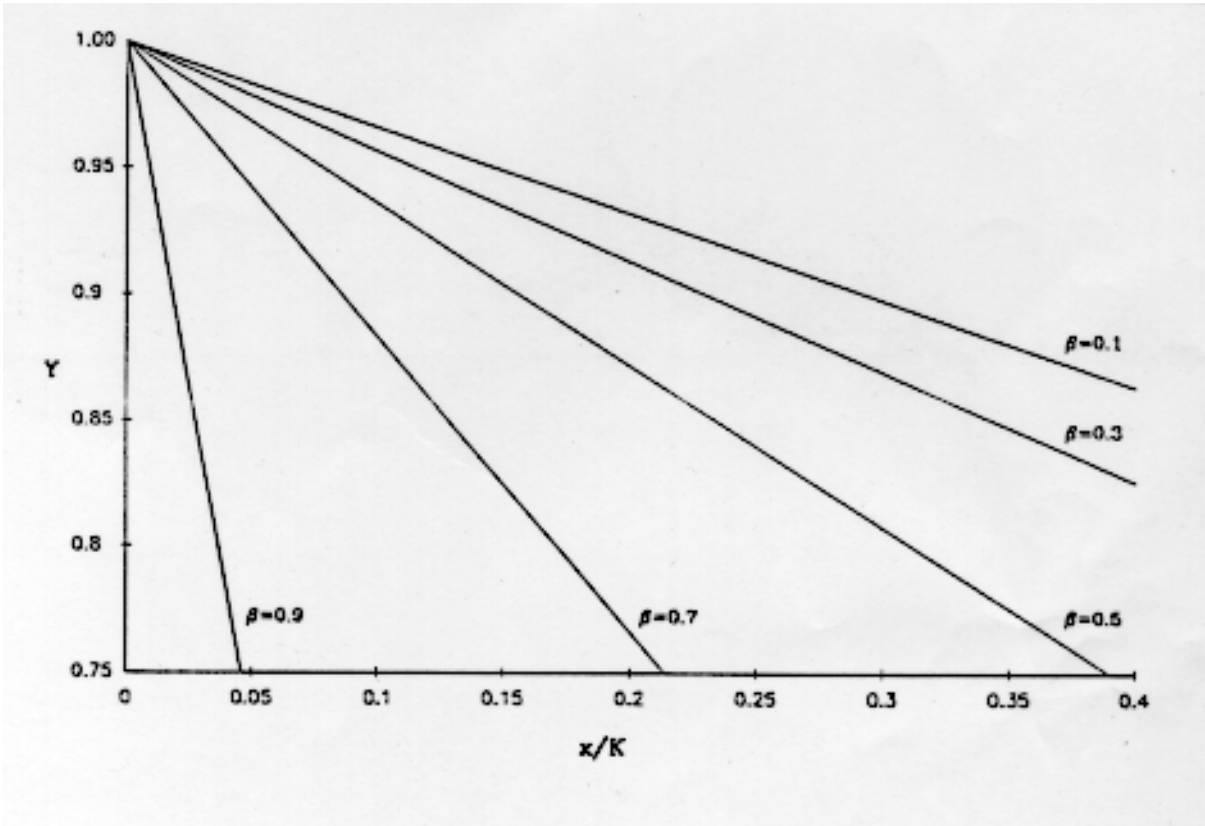
Appendix II: Orifice Expansion Coefficient for Pipe Tag

APPENDIX II

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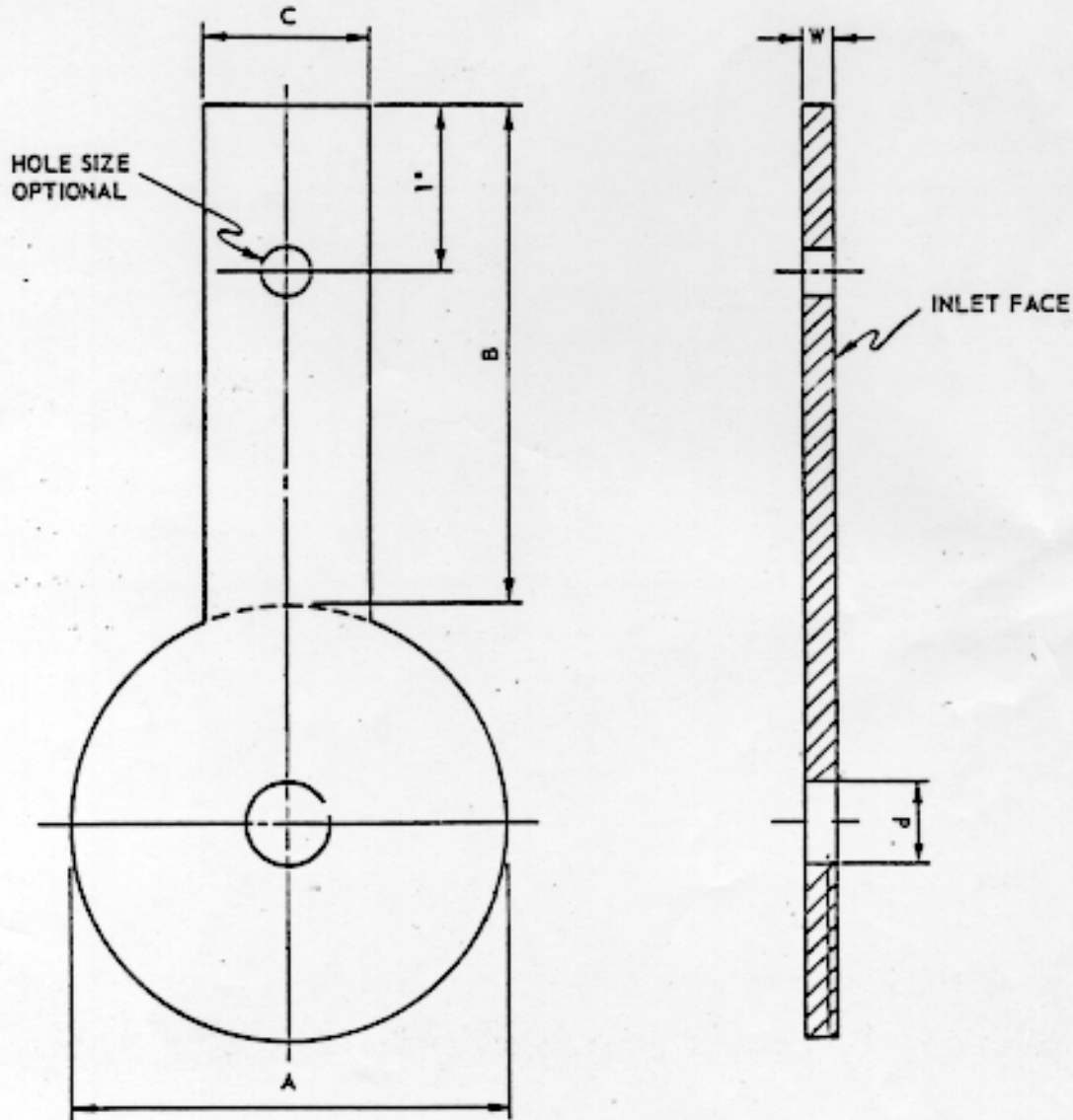
Nom. Pipe Size Inches	1" A ¹ Inches ± 1/64																C INCHES ± 1/64	Σ Notes 1 & 2 INCHES ± 0.004	P Notes 1, 6 INCHES	W Notes 3 INCHES	Nom. Pipe Size Inches																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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2	223-3/4	224-1/8	224-1/2	224-3/4	225-1/8	225-1/2	225-3/4	226-1/8	226-1/2	226-3/4	227-1/8	227-1/2	227-3/4	228-1/8	228-1/2	228-3/4	229-1/8	229-1/2	229-3/4	230-1/8	230-1/2	230-3/4	231-1/8	231-1/2	231-3/4	232-1/8	232-1/2	232-3/4	233-1/8	233-1/2	233-3/4	234-1/8	234-1/2	234-3/4	235-1/8	235-1/2	235-3/4	236-1/8	236-1/2	236-3/4	237-1/8	237-1/2	237-3/4	238-1/8	238-1/2	238-3/4	239-1/8	239-1/2	239-3/4	240-1/8	240-1/2	240-3/4	241-1/8	241-1/2	241-3/4	242-1/8	242-1/2	242-3/4	243-1/8	243-1/2	243-3/4	244-1/8	244-1/2	244-3/4	245-1/8	245-1/2	245-3/4	246-1/8	246-1/2	246-3/4	247-1/8	247-1/2	247-3/4	248-1/8	248-1/2	248-3/4	249-1/8	249-1/2	249-3/4	250-1/8	250-1/2	250-3/4	251-1/8	251-1/2	251-3/4	252-1/8	252-1/2	252-3/4	253-1/8	253-1/2	253-3/4	254-1/8	254-1/2	254-3/4	255-1/8	255-1/2	255-3/4	256-1/8	256-1/2	256-3/4	257-1/8	257-1/2	257-3/4	258-1/8	258-1/2	258-3/4	259-1/8	259-1/2	259-3/4	260-1/8	260-1/2	260-3/4	261-1/8	261-1/2	261-3/4	262-1/8	262-1/2	262-3/4	263-1/8	263-1/2	263-3/4	264-1/8	264-1/2	264-3/4	265-1/8	265-1/2	265-3/4	266-1/8	266-1/2	266-3/4	267-1/8	267-1/2	267-3/4	268-1/8	268-1/2	268-3/4	269-1/8	269-1/2	269-3/4	270-1/8	270-1/2	270-3/4	271-1/8	271-1/2	271-3/4	272-1/8	272-1/2	272-3/4	273-1/8	273-1/2	273-3/4	274-1/8	274-1/2	274-3/4	275-1/8	275-1/2	275-3/4	276-1/8	276-1/2	276-3/4	277-1/8	277-1/2	277-3/4	278-1/8	278-1/2	278-3/4	279-1/8	279-1/2	279-3/4	280-1/8	280-1/2	280-3/4	281-1/8	281-1/2	281-3/4	282-1/8	282-1/2	282-3/4	283-1/8	283-1/2	283-3/4	284-1/8	284-1/2	284-3/4	285-1/8	285-1/2	285-3/4	286-1/8	286-1/2	286-3/4	287-1/8	287-1/2	287-3/4	288-1/8	288-1/2	288-3/4	289-1/8	289-1/2	289-3/4	290-1/8	290-1/2	290-3/4	291-1/8	291-1/2	291-3/4	292-1/8	292-1/2	292-3/4	293-1/8	293-1/2	293-3/4	294-1/8	294-1/2	294-3/4	295-1/8	295-1/2	295-3/4	296-1/8	296-1/2	296-3/4	297-1/8	297-1/2	297-3/4	298-1/8	298-1/2	298-3/4	299-1/8	299-1/2	299-3/4	300-1/8	300-1/2	300-3/4	301-1/8	301-1/2	301-3/4	302-1/8	302-1/2	302-3/4	303-1/8	303-1/2	303-3/4	304-1/8	304-1/2	304-3/4	305-1/8	305-1/2	305-3/4	306-1/8	306-1/2	306-3/4	307-1/8	307-1/2	307-3/4	308-1/8	308-1/2	308-3/4	309-1/8	309-1/2	309-3/4	310-1/8	310-1/2	310-3/4	311-1/8	311-1/2	311-3/4	312-1/8	312-1/2	312-3/4	313-1/8	313-1/2	313-3/4	314-1/8	314-1/2	314-3/4	315-1/8	315-1/2	315-3/4	316-1/8	316-1/2	316-3/4	317-1/8	317-1/2	317-3/4	318-1/8	318-1/2	318-3/4	319-1/8	319-1/2	319-3/4	320-1/8	320-1/2	320-3/4	321-1/8	321-1/2	321-3/4	322-1/8	322-1/2	322-3/4	323-1/8	323-1/2	323-3/4	324-1/8	324-1/2	324-3/4	325-1/8	325-1/2	325-3/4	326-1/8	326-1/2	326-3/4	327-1/8	327-1/2	327-3/4	328-1/8	328-1/2	328-3/4	329-1/8	329-1/2	329-3/4	330-1/8	330-1/2	330-3/4	331-1/8	331-1/2	331-3/4	332-1/8	332-1/2	332-3/4	333-1/8	333-1/2	333-3/4	334-1/8	334-1/2	334-3/4	335-1/8	335-1/2	335-3/4	336-1/8	336-1/2	336-3/4	337-1/8	337-1/2	337-3/4	338-1/8	338-1/2	338-3/4	339-1/8	339-1/2	339-3/4	340-1/8	340-1/2	340-3/4	341-1/8	341-1/2	341-3/4	342-1/8	342-1/2	342-3/4	343-1/8	343-1/2	343-3/4	344-1/8

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Notes 1. "D" : 배관 구경

2. "d" : 동심 Orifice의 구경

3. 운전온도, 운전압력, Orifice의 전후단 차압등이 높은 경우에는 위 Table에서 보여진 두께보다 두꺼워야 한다.