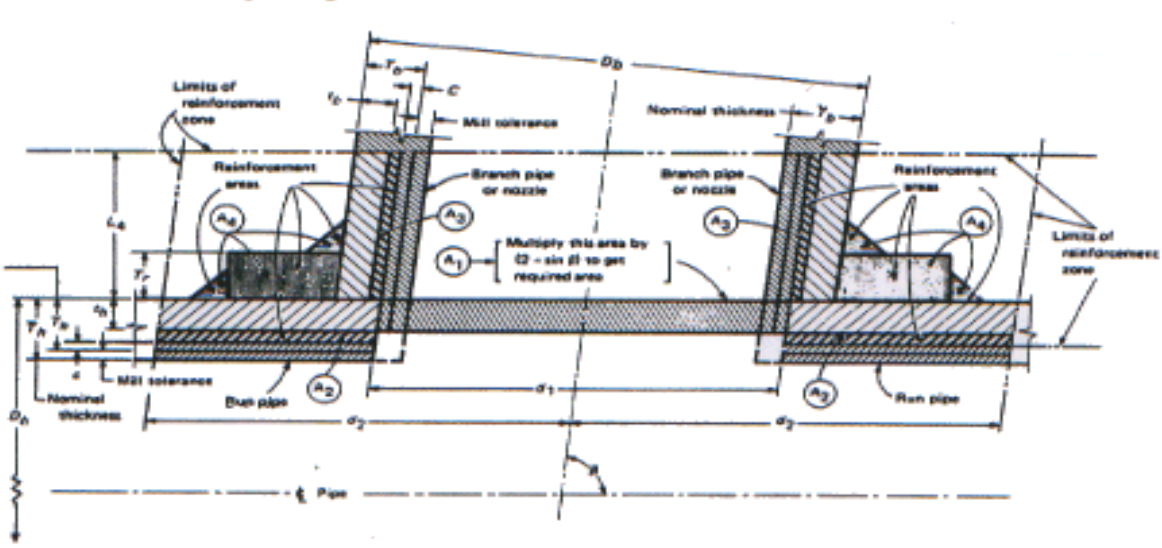
Branch Saddle Design Information

Fully Pressure-Rated Branch-Saddle Fittings

A pipe having a branch outlet connection is weakened by the opening that must be made in it. Unless the wall thickness of the pipe is sufficiently in excess of that required to sustain the full pressure, it is necessary to provide added reinforcement. The amount of added reinforcement required to sustain the pressure is governed by the area replacement method. Basically, the volume of the pipe-wall coupon from the hole for the branch is replaced by added volume and mass in critical zones around the branch outlet. This methodology is detailed in ASME Code for Pressure Piping B31.3 "Process Piping" section #304.3.2 and #304.3.3. Where the 800 psi hoop-stress of the branch outlet and the 800 psi hoop-stress of the main pipe meet at the joint intersection, extra material must be added to reduce the intensified stress in the joint to the allowable 800 psi long term stress.

BRANCH CONNECTION NOMENCLATURE ASME B31.3-1996 Edition



Tests conducted on non-reinforced branch connections proves that the branch outlets in line tees and reducing tees are generally reduced in strength by about 45% depending on the ratio of the pipe diameters.

Pressure Reduction Ratios in Percent for Unreinforced Intersections*

Branch Size / Header Size	1"	1½"	2"	2½"	3"	4"	6"	8"	10"	12"	14"	16'	18"	20"	24"
1'	100														
1½"	100	100													
2"	100	100	89												
2½"	80	71	67	66											
3'	77	69	65	64	63										
4'	100	65	62	61	61	59									
6'	100	100	100	58	57	56	58								
8"	100	100	100	56	55	54	56	55							
10"	100	100	100	56	55	54	56	55	55						
12"	100	100	100	56	55	55	57	56	55	55					
14"	100	100	100	56	55	54	57	56	55	54	54				
16"	100	100	100	56	55	55	57	56	56	55	54	54			
18"	100	100	100	56	55	55	57	56	55	55	54	53	53		
20"	100	100	100	56	55	55	57	56	56	55	55	54	53	53	
24"	100	100	100	56	55	55	57	56	56	55	55	54	53	53	52

*Based on the Code for Pressure Piping, ASA B31.1 for: standard weight pipe with 0.1 corrosion allowance: leg of Fillet weld =¼" for branches 4" or smaller, and 3/8" for larger branch sizes.

Branch Saddle Heater Plate Information

Most common branch saddles are produced by machining a branch of a molded tee. Their reinforcement is meant for that size on size tee! It was not engineered to meet all reducing outlet tee design combinations. For example, using the area or volume replacement method of ASMEB31.3 for reinforcement, the borehole mass drilled from a 24" DR-11 pipe wall for a 2" outlet, is about 6.5 cubic inches. The muff area around the 2" tee-type branch-saddle is not nearly 6.5 cu. in. Thus the 2" tee-type branch-saddle on a 24 " DR-11 pipe is not fully pressure rated. The muff reinforcement of the 2" branch saddle has sufficient mass on it to fully pressure-rate 3" x 2", 4" x 2" and 6" x 2" reducing tee. Above 6" mains, the 2" saddle reinforcement does not fully replace the mass of the pipe wall removed for the outlet hole. Each branch saddle reinforcement should be reviewed for its capacity to replace the mass of the hole drilled through the specified pipe-main in order to maintain a full working pressure rating.

The Massive Branch Saddles (MBS) of the DIPS sizes are engineered to cover a wide range of reducing outlets through 24" DIPS pipe mains. The mass of the base reinforcement exceeds the mass of the hole cut from the main to which it will be fused. Thus the full pressure rating is preserved.

Most contractors wish to use the same heater plates that they now have. This is accomplished by jumping one base size or diameter compared to the outlet diameter, starting with the 4" outlets. For example, to fuse on a 4" DIPS outlet, investigate using the 6" IPS or 6" DIPS concave/convex heater plate set. To fuse on an 8" DIPS outlet, investigate using a 10" IPS or 8" DIPS heater plate set. Contact your fusion equipment manufacturer to record below, the following Heater Plate Sets that apply for your fusion machine:

IPS
(Reduced Port: Reduced ID)

IPS-Size	Base OD	Base ID	Htr.Pl. Set #
2"(2.38)	2.6"	1.90"	#
3"(3.50)	3.9"	2.75"	#
4"(4.50)	4.8"	3.40"	#
6"(6.63)	7.3"	5.20"	#
8"(8.63)	9.4"	7.06"	#
10"(10.75)	11.5"	8.80"	#
12"(12.75)	13.8"	10.43"	#
********	**	**	
********	**	**	
********	**	**	
********	**	**	
********	**	**	

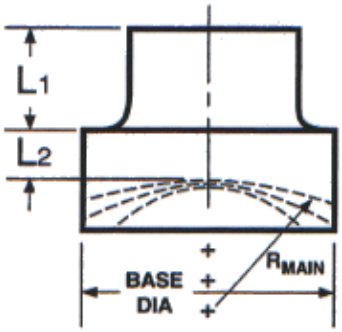
DIPS
(Full Port: Full Full-ID)

Htr. Pl. Set#	Base OD	Base ID	DIPS-Size
#	***	***	***
#	***	***	***
#	6.6"	3.90"	4"(4.80)
#	8.63"	5.62"	6"(6.90)
#	11.50"	7.38"	8"(9.05)
#	13.80"	9.04"	10"(11.10)
#	16.00"	10.75"	12"(13.20)
#	18.00"	12.51"	14"(15.30)
#	20.00"	14.17"	16"(17.40)
#	22.00"	15.93"	18"(19.50)
#	24.00"	17.59"	20"(21.60)
#	28.00"	21.00"	24"(25.80)

"IPS" Massive Branch Saddles designed for full bore, full pressure rating for all main & outlet combinations are available. Call for a Quote.

IPS Branch Saddles

(Dimensions in Inches)



- "Blank" branch saddles stocked in DR-11.
- Branch saddle "blank" machined per order to radius of pipe main size; and re-bored to DR.
- Branch saddles can be machined to main sizes up to 63".
- Purchaser must determine that concave/convex heater plate adapters are available to complete the saddle fusion.

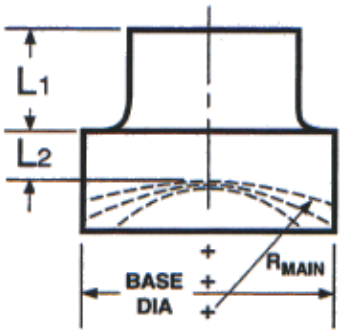
Outlet Size	Main Size Range	L1	L2	Base Diameter	DR	Weight (lbs)
2" IPS	3 - 12 14 - 34 36 - 54	3.25	0.2	2.6	11	1
3" IPS	4 - 12 14 - 34 36 - 54	3.25	0.5	3.9	11	1
4" IPS	6 - 12 14 - 34 36 - 54	3.25	0.5	4.8	11	2
6" IPS	8 - 12 14 - 34 36 - 54	3.25	0.7	7.3	11	4
8" IPS	10 - 12 14 - 34 36 - 54	6.0	0.7	9.4	11	9
10" IPS	12 14 - 34 36 - 54	6.0	1.0	11.5	11	16
12" IPS	14 - 34 36 - 54	8.0	1.0	13.8	11	32

Order information needed:
IPS Outlet & DR x Exact Main Diameter

IPS branch saddles meet AWWA C901/C906 fitting requirements.

DIPS Branch Saddles

(Dimensions in Inches)

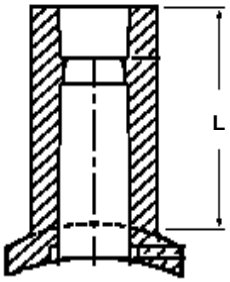


- "Blank" branch saddles stocked in DR-11.
- Branch saddle "blank" machined per order to radius of pipe main size; and re-bored to DR.
- Branch saddles can be machined thru 54" main size.
- Purchaser must determine that concave/convex heater plate adapters are available to complete the saddle fusion.

Outlet Size	Main Size Range	L1	L2	Base Diameter	DR	Weight (lbs)
2" IPS	3 - 12 14 - 34 36 - 54	3.2	0.2	2.6	11	1
3" IPS/DIPS	4 - 12 14 - 34 36 - 54	3.2	0.5	3.9	11	1
4" DIPS	6 - 12 14 - 34 36 - 54	4.0	1.0	6.6	11	4
6" DIPS	8 - 12 14 - 34 36 - 54	5.0	1.5	8.6	11	9
8" DIPS	10 - 12 14 - 34 36 - 54	6.0	1.5	11.5	11	17
10" DIPS	12 14 - 34 36 - 54	8.0	2.0	13.8	11	31
12" DIPS	14 - 34 36 - 54	10.0	2.0	15.3	11	47

Order information needed:
DIPS Outlet & DR x Exact Main Diameter

DIPS branch saddles meet AWWA C901/C906 fitting requirements.



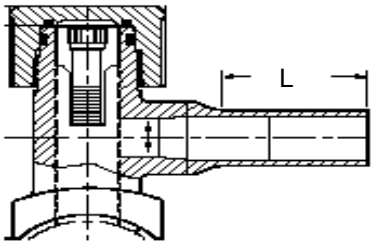
IPS Service Saddles Rectangular Base

(Dimensions in Inches)

Size	L	Base Size (rectangular)	DR	Weight (lbs)
1-1/4 x 3/4 1-1/4 x 1	2.83	2.44" x 2.00"	9	0.2
1-1/2 x 3/4 1-1/2 x 1	2.83	2.44" x 2.00"	9	0.2
2 x 3/4 2 x 1 2 x 1-1/4	2.83 2.83 2.06	2.44" x 2.00"	9	0.2
3 x 3/4 3 x 1 3 x 1-1/4	2.83 2.83 2.06	2.44" x 2.00"	9	0.2
4 x 3/4 4 x 1 4 x 1-1/4	2.83 2.83 2.06	2.44" x 2.00"	9	0.2
6 x 1 6 x 1-1/4	2.83 2.83 2.06	2.44" x 2.00"	9	0.2
8 x 1	2.83	2.44" x 2.00"	9	0.1

Many other service saddles are available including larger outlets, other radius and "high volume service saddles" - Call For Quick Quote.

Molded fittings meet AWWA C901/C906 fitting requirements.



IPS Self-Tapping Tees Rectangular Base

(Dimensions in Inches)

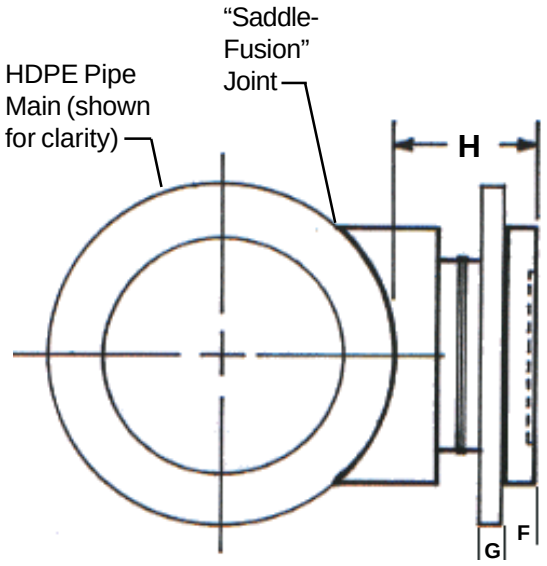
Size	L	Base Size (rectangular)	DR	Weight (lbs)
1-1/4 x 1	3.05	1.91 x 2.50	9	1
1-1/2 x 1	3.05	1.91 x 2.50	9	1
2 x 1 2 x 1-1/4	3.05 3.05	1.91 x 2.50	9	1
3 x 1 3 x 1-1/4	3.05 3.05	1.91 x 2.50	9	1
4 x 1 4 x 1-1/4	3.05 3.05	1.91 x 2.50	9	1
6 x 1 6 x 1-1/4	3.05 3.05	1.91 x 2.50	9	1
8 x 1 8 x 1-1/4	3.05 3.05	1.91 x 2.50	9	1

Many other tapping tees are available including larger outlets, other radius, and "high volume tapping tees" - Call For Quick Quote.

Molded fittings meet AWWA C901/C906 fitting requirements.

IPS & DIPS Tapping Sleeve / Saddle Assembly

Full Pressure Rated - MSS SP-60 & AWWA C906 Compliant



The normal method of field tapping a mainline is to apply a tapping saddle and tap through the tapping valve into the main, remove the cutter and coupon and close the valve. It is advantageous to fabricate a branch saddle fused to a flange adapter with a one-piece metal back up ring captured between, this has been done for years. These "wet-tap" assemblies are fabricated to minimize the vertical height from the pipe crown to the flange face. This assembly complies with **MSS SP-60**, the Standard Practice of the MSS (Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.). These assemblies are engineered to accept tapping valves, whereas ordinary flanges will not accept tapping valves. The assembly consists of a custom-engineered branch saddle fused to a customized flange adapter with a centered back up ring. Tapping Sleeve / Saddles are nominally fused to the main pipe on the horizontal.

Outlet Size	Main Size Range	G (Back Up Ring)	F (Flange Face)	H (Height)	DR	WPR (psi)
4"	6 - 12 14 - 34 36 - 54	0.94	1.00	8.50	11	160
6"	8 - 12 14 - 34 36 - 54	1.00	1.25	8.50	11	160
8"	10 - 12 14 - 34 36 - 54	1.12	1.50	9.00	11	160
10"	12 14 - 34 36 - 54	1.19	2.00	10.50	11	160
12"	14 - 34 36 - 54	1.50	2.25	10.50	11	160

See next page for information on cutter sizes for taps.

CAUTION:

Insure that the field fusion equipment has adapters to hold the assembly with sufficient clearance opening and closure stroke to complete fusion.

User supplied longer bolts may be required to accept flange face and metal back up ring.

Cutter Sizes for Taps

For line-size branch outlets, the proper cutter diameter for HDPE taps is accepted to be as large as 75% to 90% of the inside diameter of the pipe main. Note: The cutter must fit through the branch. It is acceptable to use a hole-cutter whose metal OD is up to at least 75% of the ID of the HDPE main pipe, but no larger than 90% of the HDPE main ID. Obviously, the cutter can be smaller for smaller branch-outlets.

Some users want the "maximum" diameter opening, thinking that it will maximize the water volume throughput and minimize the pressure loss through the fitting. A detailed examination of the numbers reveals the following:

Using a portal outlet cutter hole diameter that is nominally 87% of the ID of the pipe main, a detailed examination of the pressure loss through the "orifice" of the cut hole was done. The results confirmed that the pressure loss was negligible, almost insignificant. The pressure loss was equal to about 3 diameters of extra pipe length.

The pressure loss was less than 0.010 psi....1/100 th of one psi.

A full copy of the detailed report is available upon request.

Using the cutter size range of up to **75% to 90% of the HDPE main pipe ID**, the user can choose a cutter diameter that fits through the branch to provide good flow at minimum pressure loss and avoid tapping problems.

Note: When using **line-size metal tapping sleeves**, the cutter OD should be smaller, usually about **75%** of the pipe main inside diameter to avoid cutting through the spring line of the HDPE pipe main and not allowing the removal of the HDPE pipe coupon. The cutter OD should not be as large as the ID of the HDPE pipe main so that when the coupon is removed, it will retract freely within the cutter.

In all cases, the cutter OD **must** be slightly smaller in diameter than the HDPE pipe-main ID!!