

## SPECIFICATION FOR ABRASION RESISTANT PIPE

PERMALOY™ abrasion resistant pipe is alloyed centrifugally cast ductile iron pipe and offers superior abrasion resistance for hydraulic or pneumatic conveyance of fly and bottom ash, mine tailings, sewage and all other abrasive materials. PERMALOY™ I is a tin, copper and chrome alloyed pipe possessing a minimum Brinell hardness of 280 at the inside diameter and approximately 400 at the outside diameter. PERMALOY™ II is a nickel, molybdenum and chrome alloyed pipe possessing a minimum Brinell hardness of 475 at the inside diameter and approximately 550 at the outside diameter. The design characteristics of PERMALOY™ I and II pipe produce a thick walled product possessing a high Brinell hardness inside diameter which becomes progressively harder toward the outside diameter. The result of this characteristic is that the product becomes progressively resistant to wear the longer it is in service.



### Physical Properties

The physical properties listed below for PERMALOY™ I and PERMALOY™ II are based upon above ground installations and temperatures up to 800°F. According to technical data available, the effect of temperature upon these properties is very minimal. At still higher temperatures, e.g. 1200°F, PERMALOY™ I and PERMALOY™ II remain micro-structurally stable, resistant to oxidation and strong enough for most above ground installations.

Material	Average Impact resistance	Average Tensile Strength
PERMALOY™ I	1.3 ft. lbs.	90,000 psi
PERMALOY™ II	4.4 ft. lbs.	150,000 psi
Gray Cast Iron	1.0 ft. lbs.	30,000 psi
Ductile Cast Iron	7.0 ft. lbs.	60,000 psi

Pipe line abrasion and corrosion annually costs industry millions of dollars and although it is extremely difficult to predict actual service life due to many variables involved, all things being equal, the wall thickness and BHN hardness will affect the service life in any given system.

## CLOW

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### NOMINAL PIPE DATA

### WEIGHTS\*

NOMINAL SIZE INCHES	END** CONNECTION	(O.D.) OUTSIDE DIAMETER	NOMINAL WALL THICKNESS	MINIMUM WALL THICKNESS	18 FOOT PLAIN END	18 FOOT MECH. JOINT
6 (AB)	Plain	6.90	.55	.50	655	-
6 (AB)	Mech. Jt.	6.90	.55	.50	-	660
6 (CD)	Plain	7.10	.55	.50	675	-
8 (AB)	Plain	9.05	.56	.51	890	-
8 (AB)	Mech. Jt.	9.05	.56	.51	-	895
8 (AB)	Plain	9.05	.65	.60	1020	-
8 (AB)	Mech. Jt.	9.05	.65	.60	-	1020
8 (CD)	Plain	9.30	.65	.60	1045	-
10 (AB)	Plain	11.10	.57	.51	1125	-
10 (AB)	Mech. Jt.	11.10	.57	.51	-	1135
10 (AB)	Plain	11.10	.70	.64	1350	-
10 (AB)	Mech. Jt.	11.10	.70	.64	-	1360
10 (CD)	Plain	11.30	.70	.64	1390	-
12 (AB)	Plain	13.20	.62	.58	1455	-
12 (AB)	Mech. Jt.	13.20	.62	.58	-	1465
12 (AB)	Plain	13.20	.75	.69	1730	-
12 (AB)	Mech. Jt.	13.20	.75	.69	-	1740
12 (CD)	Plain	13.50	.75	.69	1770	-
14 (AB)	Plain	15.30	.75	.67	1985	-
14 (AB)	Mech. Jt.	15.30	.75	.67	-	2015
16 (AB)	Plain	17.40	.75	.67	2270	-
16 (AB)	Mech. Jt.	17.40	.75	.67	-	23.15

\* Weights are calculated to the nearest 5 pounds. \*\* Flanged joint end connections are available in Ductile Iron only.

\* Per ANSI/A21.51 - 1976. Revision an additional minus tolerance of .02" shall be permitted along the barrel of the pipe for a distance not to exceed 12".

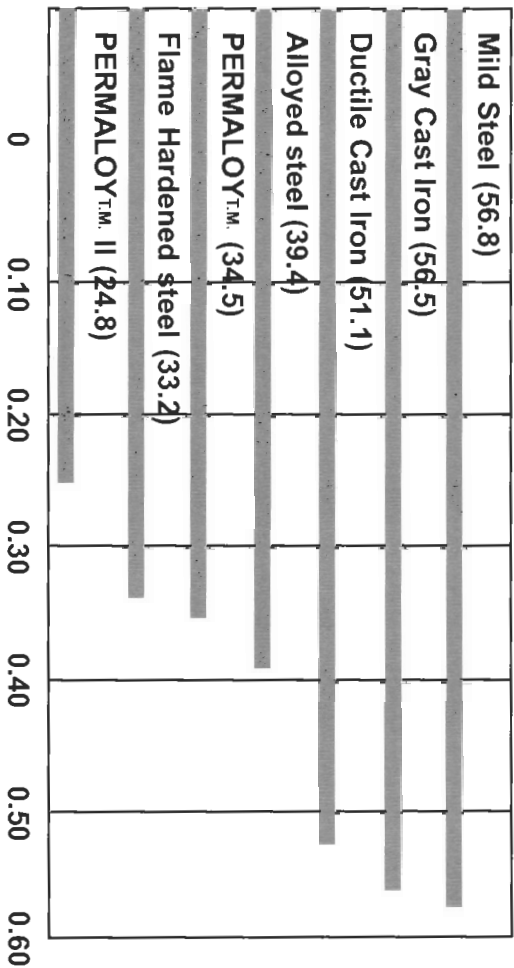
### Tolerances

Outside Diameter:	6" thru 12" 14" and 16"	=	+/- .06" +/- .08"
Wall Thickness:	6" thru 8" 10" and 12" 14" and 16"	=	-.05" + .08" -.06" + .09" -.08" + .08"
Laying Lengths:	Plain End Flanged Mech. Jt.	=	18'-0" +/- .25" 18'-0" +/- .125" 18'-3" +/- .3"

### Ordering

We must be allowed to supply 10% of any order

# I. D. PIPE WALL EROSION RESULTS



As can be seen from this table, PERMALLOY™ II offered the best resistance to abrasion

- Thick wall
- Temperature and Impact Resistance
- Longer Service

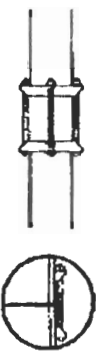
## Testing and Inspection

- Microstructures are evaluated and hardness tests performed on representative pipe to insure proper iron matrix and hardness
- Iron analyses are closely monitored and controlled
- Thickness tests are performed on each piece of pipe
- Each pipe is ring gauged to insure proper outside diameters

## JOINTS

PERMALLOY™ pipe is available in plain end, flanged (per ANSI B16.1), and mechanical joint (per ANSI A21.11) end connections to simplify the joining and rotating of pipe fittings

### PLAIN END connected by a cast coupling



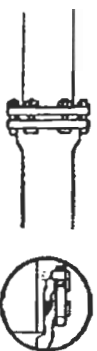
- Easy to install
- Easy to rotate
- Flexible connection

### FLANGED

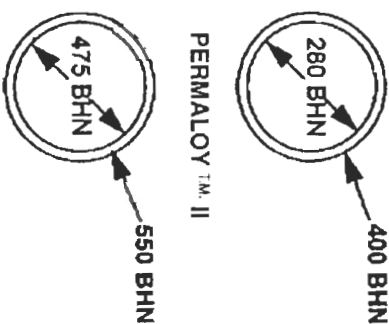


- Easy to install
- Flexible connection

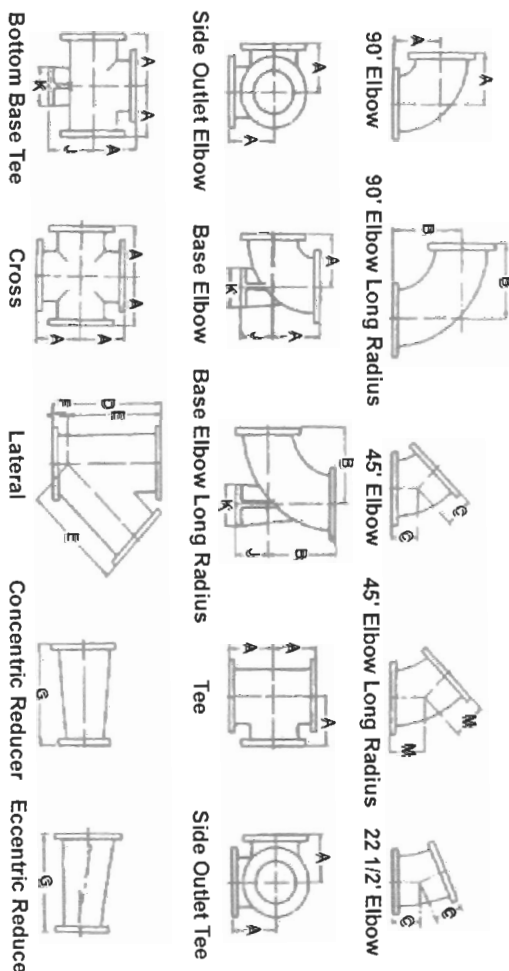
### MECHANICAL JOINT



- Easy to install
- Flexible connection



# PERMALLOY™ FITTINGS/450-550 BHN



Size of all fittings listed indicates nominal inside diameter of port.

Fittings are usually more subject to increased abrasion than straight runs of pipe as the particles generally strike a smaller surface area at higher angle of impact. This most often occurs at bends and other changes in direction or size.

PERMALLOY™ flanged and mechanical joint fittings, specially alloyed and heat treated to a martensitic nodular iron structure, exhibit 450-550 Brinell hardness.

Flanged fittings are also available "double drilled" to allow for more pipe rotations to increase the service life of the pipe.

## Composition and Physical Properties

- Nickel and Molybdenum alloyed nodular iron-oil quenched
- 200,000 psi average tensile strength
- 450-550 Brinell hardness range
- Impact strengths of 3 to 1 over gray cast iron
- 3.0 times the wear resistance of mild steels

Note: Our fittings do not have ware-backs

SIZE INCHES	DIA. OF FLANGE	DIMENSIONS - INCHES										
		A	B	C	D	E	F	G	J	K	M	
3	7 1/2	5 1/2	7 3/4	3	13	10	3	6	4 7/8	5	4	
4	9	6 1/2	9	4	15	12	3	7	5 1/2	6	5 1/4	
5	10	7 1/2	10 1/4	4 1/2	17	13 1/2	3 1/2	8	6 1/4	7	6	
6	11	8	11 1/2	5	18	14 1/2	3 1/2	9	7	7	6 3/4	
8	13 1/2	9	14	5 1/2	22	17 1/2	4 1/2	11	8 3/4	9	8	
10	16	11	16 1/2	6 1/2	25 1/2	20 1/2	5	12	9 3/4	9	9	
12	19	12	19	7 1/2	30	24 1/2	5 1/2	14	11 1/4	11	9 1/2	
14	21	14	21 1/2	7 1/2	33	27	6	16	12 1/2	11	10	
16	23 1/2	15	24	8	36 1/2	30	6 1/2	18	13 3/4	11	13	
18	25	16 1/2	26 1/2	8 1/2	39	32	7	19	15	13 1/2	14	
20	27 1/2	18	29	9 1/2	43	35	8	20	16	13 1/2	15	
24	32	22	34	11	49 1/2	40 1/2	9	24	18 1/2	13 1/2	17	
30	38 3/4	25	-	15	-	-	-	30	23	16	-	

Mechanical joint end connections are also available in sizes 3" through 30".

All Clow products are proudly made in the U.S.A.