

HARD CORE X

GET THE MAXIMUM LIFE OUT OF YOUR STEEL PIPE

A tough one piece ductile abrasion resistant hardened steel pipe. Engineered for maximum life in highly abrasive applications. With HARD CORE X 600 Brinell Ld. and 300 BHN outer hardness HARD CORE X provides the toughness required to handle the worst conditions industry can dish out. HARD CORE X overcomes the brittleness of NI-HARD and the rigidity of Basalt lining piping systems. HARD CORE X can also be fabricated in Ts, Ys, sweep and elbows. Special induction bending practices maintain wall thickness and precision quality.

SPECIFICATIONS

LENGTHS: 20 and 40 foot standard; custom lengths available

COUPLING METHODS: Most common methods used for carbon steel piping apply

CUTTING: Fixed mount or hand held commercial abrasive disc saw or plasma arc.

WELDING: Standard low hydrogen 7018 rod; welding procedures available

SIZES

NOMINAL	THICKNESS	OD INCHES	OD mm	INCHES	mm	WEIGHT	
						lbs./ft.	kg/m
2-1/2	SCH 80	2.87	73	.267	.01	8	11
3	SCH 80	3.50	89	.300	7.62	10	15
4	SCH 80	4.50	114	.337	8.56	151	22
5	SCH 80	5.56	141	.375	9.53	21	31
6	SCH 40	6.63	168	.280	7.11	19	28
6	SCH 80	6.63	168	.432	10.97	29	43
8	SCH 40	8.63	219	.322	8.18	29	43
8	SCH 80	8.63	219	.500	12.7	43	65
10	SCH 40	10.75	273	.365	9.27	40	61
10	XH	10.75	273	.500	12.7	55	82
12	STD	12.75	324	.375	9.53	50	74
12	XH	12.75	324	.500	12.7	65	97
14	STD	14	356	.375	9.53	55	81
14	XH	14	356	.500	12.7	72	107
16	STD	16	406	.375	9.53	63	93
16	XH	16	406	.500	12.7	83	123
18	STD	18	457	.375	9.53	71	105
20	STD	20	508	.375	9.53	79	117
22	STD	22	559	.375	9.53	87	129
24		24	610	.438	11.13	110	164

APPLICATIONS

POWER GENERATION

Coal Slurry Transport
Fly Ash Systems
Pulverized Fuel Systems

MINING AND PROCESSING

Phosphate Transport
Prepping and Cleaning Plants

OTHER INDUSTRIES

Wood Chip Conveyance
Foundry
Sand Handling



HARD CORE X ... CONTINUED

MICROSTRUCTURE

- The phases of carbon steel are austenite, ferrite, pearlite, bainite and martensite. Austenite occurs at temperatures above 750°C where the carbon is fully soluble in the iron. Austenite cools to form pearlite, bainite, martensite or a combination, depending on the chemistry of a particular steel and its cooling rate.
- A soft pearlitic structure is formed when carbon steel is slow cooled. This structure, formed through diffusion is a mixture of ferrite and layers of carbides. As quenching of steel becomes more severe, the time for carbon diffusion becomes less. Upon cooling to an intermediate temperature (300°C to 500°C) and holding for a long period of time, bainite is formed. This phase is produced by a “shear” (distortion of the atomic structure) reaction followed by diffusion.
- Upon instantaneous cooling (as in the case of a vigorous water quench) a “shear” reaction occurs in the place of a diffusion reaction. The resulting product is martensite, an extremely hard phase which can reach hardness in excess of 600 Brinell.
- HARD CORE X's yield strength follows metallurgical phases through the pipe wall. The yield follows a predictable curve to a strength of 75,000 psi on the outer layer. The strength of the outer layer is more than twice that of conventional carbon steel. The implications for long-term operation are clear: pipe of a reduced wall thickness can be operated safely.
- HARD CORE X exhibits remarkable ductility - a 20 inch 00 ring can be compressed by 1.33 inches (33.8 mm). Upon release of compression, the ring will return to its original state, free from cracking.
- Conclusion: HARD CORE X demonstrates a high degree of both ductility and strength.

MANUFACTURING PROCESS

- Close process control of hardening and internal quenching is required to consistently achieve the correct micro structure and to produce the hard martensite on the inside and the soft pearlite on the outside.
- The pipe is heated by electrical induction. A current is oscillated at high frequencies through the pipe wall. The resistance of the material to the electron flow converts the electrical energy to heat energy which is closely regulated and monitored by optical pyrometers.
- The speed of the pipe and power is precisely controlled to achieve heat balance at the required temperature.
- The pipe is then subjected to internal quenching by a specially designed water quenching system. This achieves the different cooling rates required at the different points through the pipe wall to achieve the necessary material properties of inner and outer zones with a well graded transition.
- HARD CORE is also available with same above process but with a 425-575 BHN 1.0.

