

Ceram Core® Product Data

Applications

- Bottom Ash
- Wet Fly Ash
- Vanadium Ore Slurries
- Potash Tailings
- Zinc Tailings
- Taconite Tailings
- Heavy Salt Slurries
- Uranium Ore Slurries
- Dredge Lines
- Smelter Slags
- Wet Process Slurries
- Wood Pulp Slurries
- Copper Tailings
- Iron Ore Tailings
- Diatomaceous Earth
- Concrete Slurries

Materials and Construction

Ceram Core is a fiberglass reinforced epoxy resin pipe with a special abrasion resistant liner composed of small spherical beads of high alumina ceramic, held in an epoxy matrix. Because of its unique combination of ceramic beads and epoxy resin, **Ceram Core** pipe also exhibits excellent corrosion resistance.

Ceram Core piping is specifically designed for the severe abrasion conditions caused by sharp angular particles in high flow streams. Most noticeable is its successful service in handling bottom ash (see "Field Tests"):). The pipe outlasts and out performs steel, special alloys, and other lined pipe at competitive costs and is available in 6"-16" diameters in standard 30 foot (9.14 meters lengths $\pm 1/8"$), for slurry abrasion service up to 200°F (93°C). The system includes 45° and 90° elbows with a 3-diameter sweep radius. Special angle fittings, including laterals, are available on request.

Fittings

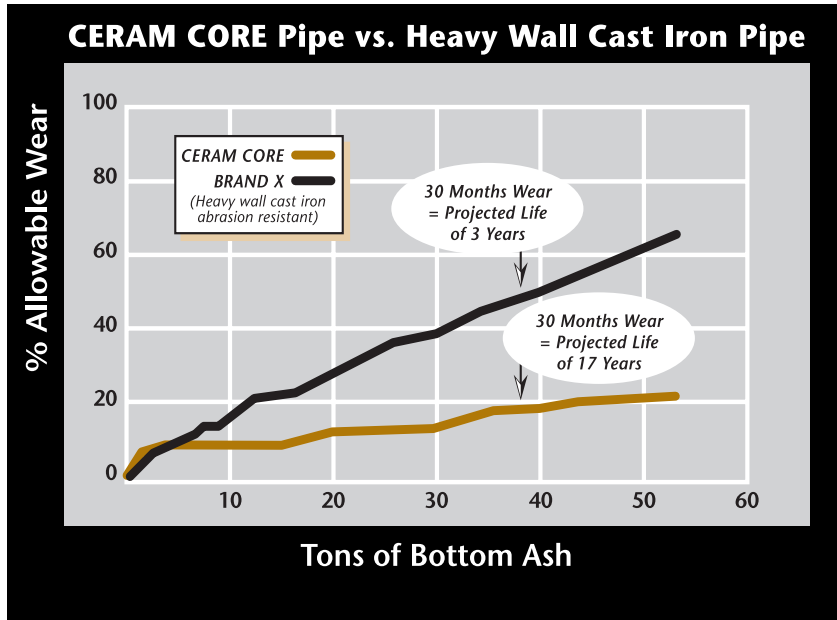
Fittings are manufactured with the same **chemical/temperature** capabilities as the pipe. Depending on the particular part and size, fittings will be compression molded, contact molded, hand fabricated or filament wound.

Nominal Dimensional Data

Nominal Pipe Size	Nominal O.D.	Nominal I.D.	Nominal Total Wall Thickness	Nominal Liner Thickness	Min. Bending Radius 75°F(24°C)	Maximum Operating Pressure	Max. Operating Temperature* Hydraulic Service	Nominal Weight
In.	In.	In.	In.	In.	Ft.	psig	°F	Lbs./Ft.
6	6.700	6.125	.288	.130	240	225	200	5.6
8	8.710	8.095	.308	.130	310	225	200	7.8
10	10.780	10.160	.310	.130	390	225	200	9.8
12	12.980	12.300	.340	.130	460	225	200	12.8
14	14.745	14.020	.363	.130	530	100	200	15.4
16	16.800	16.020	.390	.130	600	100	200	18.8

Nominal Pipe Size	Nominal O.D.	Nominal I.D.	Nominal Total Wall Thickness	Nominal Liner Thickness	Min. Bending Radius	Maximum Operating Pressure	Max. Operating Temperature* Hydraulic Service	Nominal Weight
mm	mm	mm	mm	mm	m	MPa	°C	kg/m
150	170.18	155.58	7.32	3.30	73.2	1.55	93	8.33
200	221.23	205.61	7.82	3.30	94.5	1.55	93	11.60
250	273.81	258.06	7.87	3.30	119.0	1.55	93	14.60
300	329.69	312.42	8.64	3.30	140.2	1.55	93	19.00
350	374.52	356.11	9.22	3.30	162.0	0.69	93	22.90
400	426.72	406.91	9.91	3.30	183.0	0.69	93	28.00

Significant Field Tests



An Idaho mine installed a **Ceram Core** test spool in a zinc slurry to compare it to Schedule 80 steel. Normal life for the steel was one month. After 21 months, the **Ceram Core** spool was still in service.

A **Ceram Core** test spool was installed in a Wisconsin taconite operation. Carbon steel in this application lasted from 6 to 12 months without rotation. After 19 months without rotation, the **Ceram Core** spool showed little wear.

A 10-inch diameter, 18-foot **Ceram Core** test spool was installed in bottom ash service at a major power station in Georgia. Similar test spools of other types of pipe including heavy wall abrasion resistant cast iron were also installed. After 30 months handling 53,000 tons of ash, the **Ceram Core** test spool showed a projected continuing wear life of over 17 years versus 3 years for the metallic pipe (see graph). This utility since expanded **Ceram Core** pipe use, in 8"-12" diameters, to more than 6 miles at five separate plants.

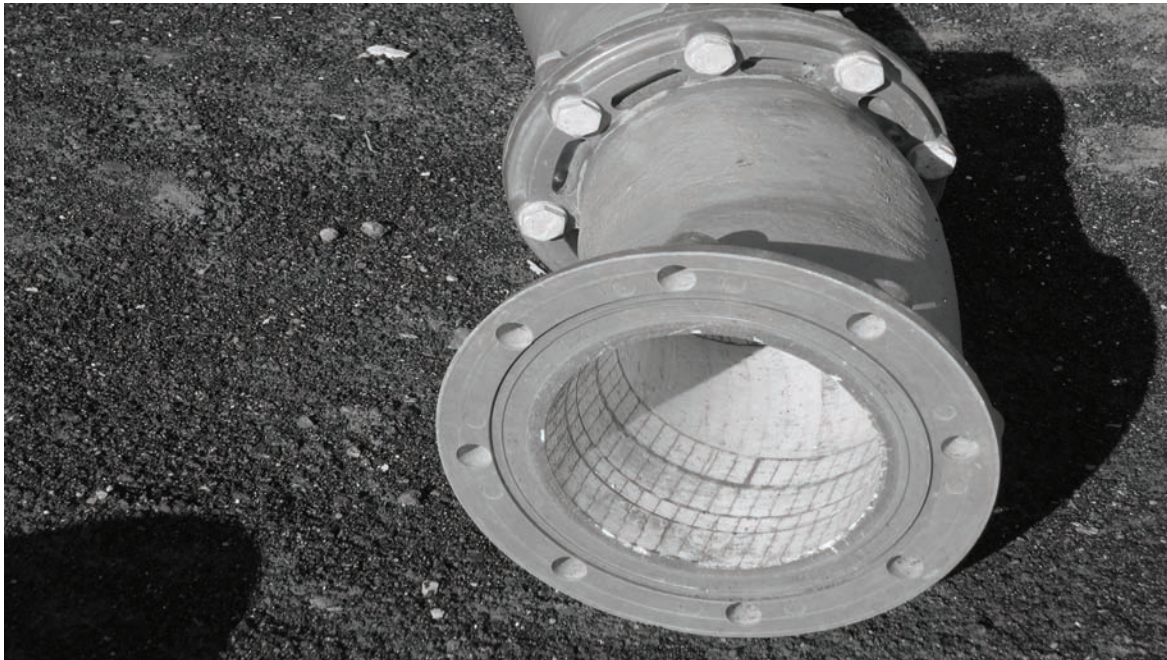
Abrasion Resistant Piping Systems Comparison									
Property	Ceram Core Pipe			Basalt Pipe			High Chromium Cast Iron Pipe		
	8"	10"	12"	8"	10"	12"	8"	10"	12"
I.D. Hardness	Brinell - Exceeds 615 MOH - 9 Rockwell - R45N - 79			- MOH - 7.8 -			Brinell - 300-500 - Rockwell - C-34-57		
Flow Factor (Hazen-Williams Coefficient)	130			100			100		
⁽¹⁾ Weight Per Foot (Lbs.)	7.2	9.8	12.8	58	70	83	55	60-70	75-93
Standard Length (Ft.)	30			18			18		
Weight Per Length of 10" Pipe(Lbs.)	294 ⁽¹⁾			1,260			1,170		
Typical Fitting Weight 90° Elbow (Lbs.)	75	125	190	326	398	462	465	760	1,130
⁽¹⁾ Weight per 30-foot length of CERAM CORE pipe includes two flanges.									

Installation Time Comparison

Ceram Core Piping vs. High Chromium Cast Iron Piping	
Submitted by:	A Midwestern electric cooperative.
Pipe Size and Type:	12" Ceram Core Pipe and 12" high chrome cast iron pipe
Straight Runs of Pipe Inside Building:	Ceram Core pipe took one-third as long as cast iron pipe to install.
Fittings Inside Building:	Ceram Core fittings took one-fourth to one-half as long as cast iron fittings to install.
Straight Runs of Pipe Outside Building:	Ceram Core pipe took one-half as long as cast iron pipe to install.
NOTE: This example does not include equipment savings to handle the two products.	

LABOR ESTIMATE EXAMPLE (Inside Building)

Pipe	Estimated Man Hours/Ft. of Pipe Installed	Estimated Man Hours to Install 6,000 ft. of Pipe	
10" Ceram Core	0.252	1,512	
10" Cast Iron	0.810	4,860	
10" Basalt	1.140	6,840	
Fittings	90°	45°	Laterals
10" Ceram Core	3.39	3.26	5.89
10" Cast Iron	7.87	7.37	10.80
10" Basalt	10.23	9.58	14.04



Ceram Core Joining Methods

Proper joining procedures are extremely important to obtain the maximum service life from **Ceram Core** pipe.

Ceram Core pipe flanges have been designed to align and seal properly when installed as directed. Particular attention must be given to accurately align pipe I.D.'s at all joints. Proper installation prevents undercutting of the lining and protects the piping system from premature wear.

Ceram Core pipe can be installed in a new or existing systems. Since dimensions vary with the application, NOV Fiber Glass Systems will design transition fittings as needed for each installation upon receipt of necessary dimensional information.

More detailed information on proper handling and installation is available in **Manual No. 6460**.

Self-aligning flanges are used on **Ceram Core** pipe and fittings to assure the inside diameters of the liners are properly aligned.

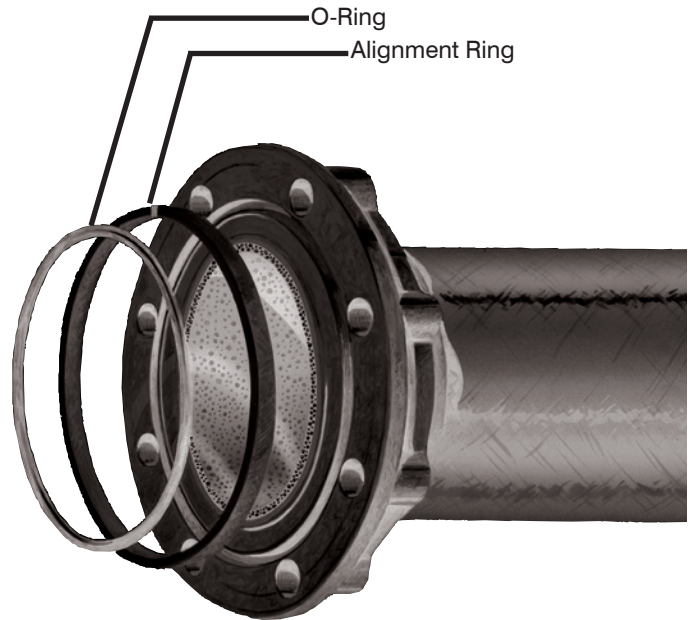
One filament wound epoxy resin aligning ring and one Buna™ N O-ring, supplied by NOV Fiber Glass Systems, is used on each joint. See **Ceram Core** pipe installation instructions, **Manual No. F6460**.

™Buna is a trademark of DuPont.

Self-Aligning Flanges



Specially designed **Ceram Core** flanges make it easy to properly align pipe and fittings when installing to new or existing systems.



Maximum Support Span @75° (24°C)

Nominal Pipe Size		Specific Gravity 1.0 / Continuous Span	
In	mm	Ft.	m
6	150	19.2	5.85
8	200	21.3	6.50
10	250	22.8	6.94
12	300	24.9	7.58
14	350	26.4	8.05
16	400	28.1	8.56

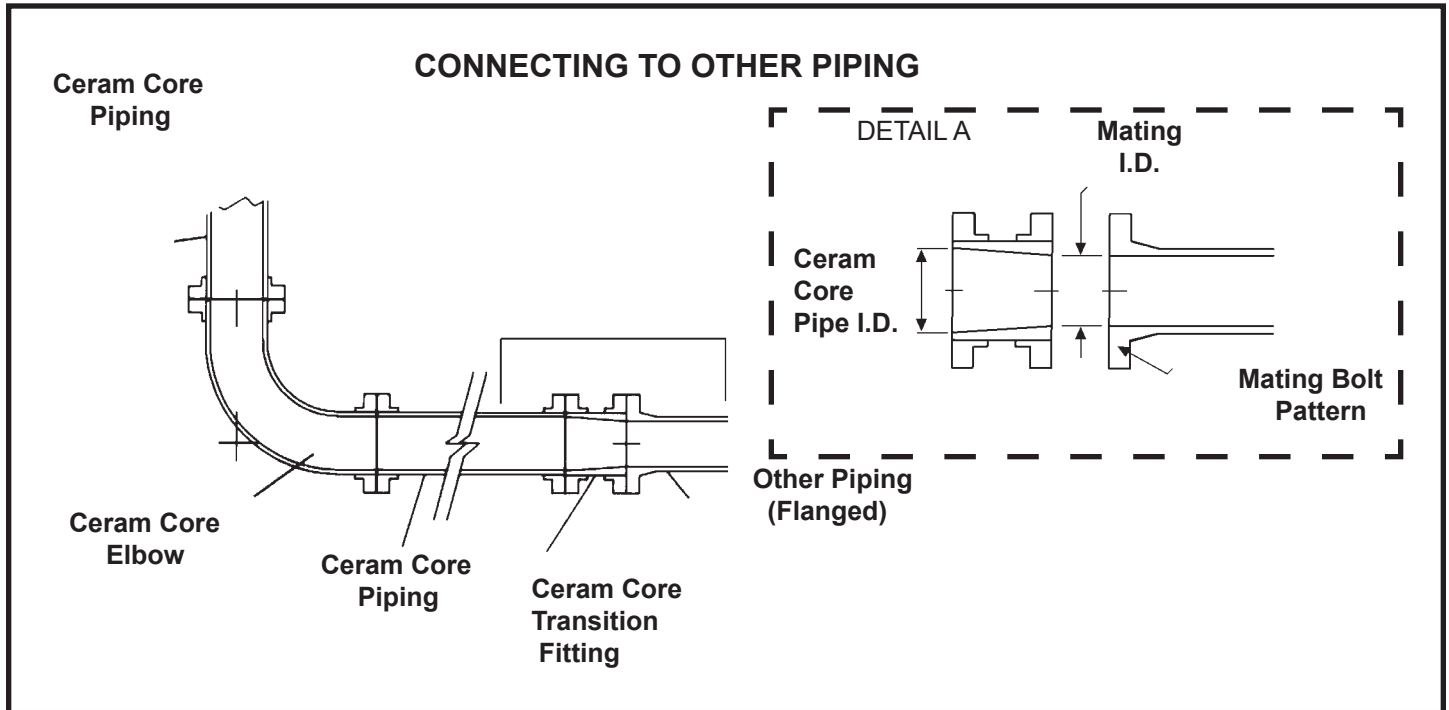
Support Span vs. Specific Gravity

Specific Gravity	.75	.9	1.0	1.1	1.25	1.5
Adjustment Factor	1.05	1.02	1.0	.98	.95	.92

Transition Fittings

Transition fittings are necessary to join **Ceram Core** pipe to systems with different inside diameters. It is essential that inside diameters of pipe-to-pipe and pipe-to-fittings be exactly matched. Mismatched I.D.'s can cause liners to be undercut and scooped away, causing premature failure.

Two flanged transition fittings generally will be required for each application. A typical concentric reducer transition fitting is shown that will join another type of flanged system having an inside diameter "XX" to a **Ceram Core** system having an inside diameter "CC."



Fittings Information

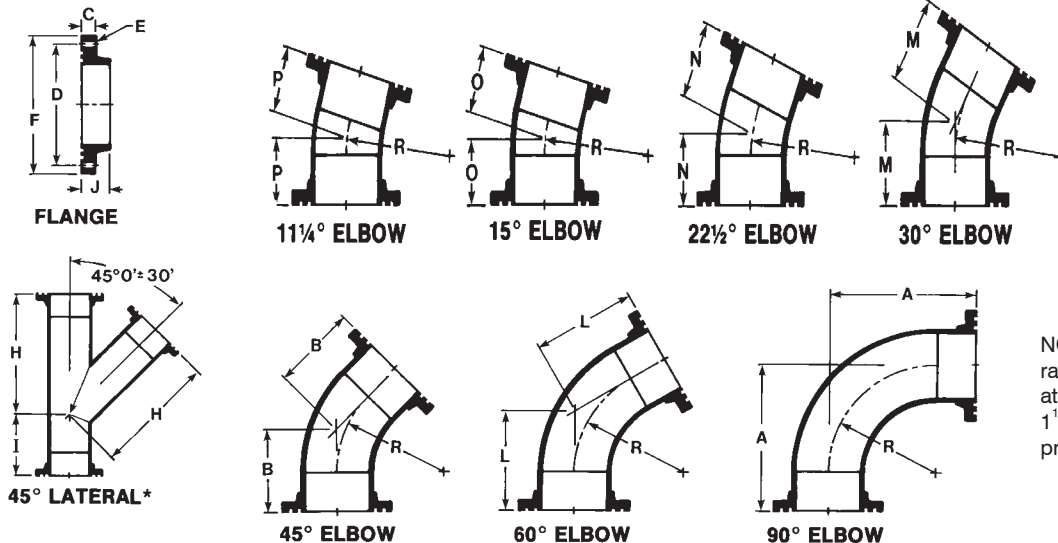
Ceram Core abrasion resistant fittings 6" through 16" diameters are available in a variety of configurations - 45° elbows and 90° elbows⁽¹⁾, 45° laterals, flanges and 11¼°, 15°, 22½°, 30°, and 60° elbows, are standard parts. Other odd degree elbows are available on request.

All fittings have liners composed of tiles similar in composition to the alumina ceramic beads used in the liner of **Ceram Core** pipe. Fittings are designed to resist high turbulence and high impact.

Ceram Core fittings have thermosetting resin and fiberglass reinforcement for physical strength. Self-aligning flanges are utilized on all fittings.⁽²⁾

Ceram Core sweep elbows have a center line radius of three times the nominal diameter (see dimension R in table).

⁽¹⁾14" and 16" sweep elbows available in 45° or less only.
⁽²⁾ See NOV Fiber Glass Systems **Manual No. 6460** for bolt torque recommendations.



NOTE: 6"-12" laterals pressure rated at 100 psig; 14" and 16" rated at 80 psig. Do not pressurize over 1½ times the maximum operating pressure.

General Fittings Dimensions (Drawings on page 6)

Nominal Pipe Size	A	B	C	D	E	F	H	I	J	L	M	N	O	P	R
In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
6	23 ¹ / ₂	12 ⁷ / ₈	1 ¹ / ₂	9 ¹ / ₂	⁷ / ₈ D-8 Holes	11	18	9	3	15 ⁷ / ₈	10 ¹ / ₄	9	7 ⁷ / ₈	7 ¹ / ₄	18
8	30 ¹ / ₂	16 ³ / ₈	1 ³ / ₄	11 ¹ / ₂	⁷ / ₈ D-8 Holes	13 ¹ / ₂	22	11	4	20 ³ / ₈	12 ⁷ / ₈	11 ¹ / ₄	9 ⁵ / ₈	8 ⁷ / ₈	24
10	37 ³ / ₄	20 ¹ / ₈	2	14 ¹ / ₄	1 D - 12 Holes	16	28	14	4 ³ / ₄	25	15	13	11 ⁵ / ₈	10 ⁵ / ₈	30
12	44 ⁵ / ₈	23 ¹ / ₂	2 ¹ / ₄	17	1 D - 12 Holes	19	30	16	5	29 ³ / ₈	18 ¹ / ₄	15	13	12 ¹ / ₈	36
14	-	22 ⁷ / ₈	2 ¹ / ₂	18 ³ / ₄	1 ¹ / ₈ D - 12 Holes	20 ³ / ₄	36	18	3 ¹ / ₈	-	16	13 ⁷ / ₈	11	9 ⁵ / ₈	42
16	-	27 ¹ / ₈	2 ¹ / ₂	21 ¹ / ₄	1 ¹ / ₈ D - 16 Holes	23 ¹ / ₄	42	21	3 ¹ / ₈	-	20 ¹ / ₈	16	13	12	48

Nominal Pipe Size	A	B	C	D	E	F	H	I	J	L	M	N	O	P	R
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
150	597	329	38	241	22 D - 8 Holes	279	457	229	76	404	262	230	200	184	457
200	775	418	44	298	22 D - 8 Holes	349	559	279	102	517	328	287	246	225	610
250	959	513	51	362	25 D - 12 Holes	406	711	356	121	637	402	349	297	271	762
300	1113	598	57	432	25 D - 12 Holes	483	813	406	127	747	465	402	340	310	914
350	-	581	64	476	29 D - 12 Holes	527	914	457	79	-	425	352	279	244	1067
400	-	689	64	540	29 D - 16 Holes	591	1067	533	79	-	511	427	345	305	1219

*Consult NOV Fiber Glass Systems concerning all pneumatic applications with **Ceram Core** pipe or any type of application exceeding 200°F (93°C).

Tolerances or maximum/minimum limits can be obtained from NOV Fiber Glass Systems.

For corrosion resistance data in liquid systems, refer to NOV Fiber Glass Systems **Manual No. E5615** and use data for Green Thread® Product.

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www.fgspipe.com

2425 SW 36th Street
San Antonio, Texas 78237 USA
Phone: 1 (210) 434-5043
Fax: 1 (210) 434-7543

2700 West 65th Street
Little Rock, Arkansas 72209 USA
Phone: 1 (501) 568-4010
Fax: 1 (501) 568-4465

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