Hose & Equipment Specs

Hammerhead Industrial Hose

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www.HammerheadHose.com

Hammerhead

Proven, highest quality hose and equipment in the industry!

and…

We stand behind our products!

- *Others attempt to imitate our hose and equipment and often copy our product names inappropriately*

* **WARNING:** many companies claim 200 psi working pressure even with low burst pressures

Don’t assume other products have similar properties as Hammerhead (they often make false claims)

“The Right Hose & Equipment Matters”

… use the right hose & equipment for the project

Things to consider:

- **Quality of the hose and equipment**
- **Fresh water vs. produced / recycled water**
- **Temperature of water and environment**
- **Water Pressure & Flow Rate**
- **Terrain & other conditions**
- **Safety and Environmental**

How do they compare?

Oroflex 30 (High quality Polyurethane (TPU))

- better puncture and abrasion resistance

Oroflex 20 (High quality Nitrile Rubber blend)

- better resistance to water with chemicals and high temperatures
- bends easier and with no damage
- returns to original diameter (after expansion due to water pressure)

*** WARNING:** many companies claim 200 psi working pressure even with low burst pressures

Don't assume other products have similar properties as Hammerhead (they often make false claims)

8” Friction Loss for Oroflex 20

Flow	Friction Loss at avg. Working Pressure		Loss w/Couplings
[barrels/min]	[psi/ft]]	[psi/mile]	[psi/mile]
0	0,00	0	0
3	0,13	1	1
6	0,27	2	2
9	0,40	5	5
12	0,53	8	9
15	0,66	12	14
18	0,80	17	19
21	0,93	23	26
24	1,06	30	33
27	1,19	38	41
30	1,33	46	51
33	1,46	55	61
36	1,59	65	72
39	1,72	76	84
42	1,86	88	97
45	1,99	100	111
48	2,12	114	125
51	2,25	128	141
54	2,39	143	157
57	2,52	159	175
60	2,65	176	194
63	2,79	193	212
66	2,92	212	233
69	3,05	232	255
72	3,18	251	276
75	3,32	272	299

- Theoretical data for fresh water at 68ºF
- For the couplings, it is considered an extra 10% friction loss (8 connections per mile)

10” Friction Loss for Oroflex 20

Flow	Friction Loss at avg. Working Pressure		Loss w/Couplings
[barrels/min]	[psi/ft]]	[psi/mile]	[psi/mile]
0	0,000	0	0
3	0,000	0	0
6	0,000	1	1
9	0,000	2	2
12	0,001	3	3
15	0,001	4	5
18	0,001	6	6
21	0,001	8	9
24	0,002	10	11
27	0,002	13	14
30	0,003	15	17
33	0,003	18	20
36	0,004	22	24
39	0,005	25	28
42	0,005	29	32
45	0,006	33	36
48	0,007	37	41
51	0,008	42	46
54	0,009	47	52
57	0,010	52	57
60	0,011	58	63
63	0,012	63	70
66	0,013	69	76
69	0,014	75	83
72	0,016	82	90
75	0,017	89	98
78	0,018	96	105
80	0,019	101	111
82	0,020	106	116
85	0,021	113	125
88	0,023	121	133
90	0,024	126	139

- Theoretical data for fresh water at 68ºF
- For the couplings, it is considered an extra 10% friction loss (8 connections per mile)

12” Friction Loss for Oroflex 20

Flow	Friction Loss at avg. Working Pressure		Loss w/Couplings
[barrels/min]	[psi/ft]]	[psi/mile]	[psi/mile]
0	0,0000	0	0
3	0,0000	0	0
6	0,0001	0	0
9	0,0001	1	1
12	0,0002	1	1
15	0,0003	2	2
18	0,0005	2	3
21	0,0006	3	3
24	0,0008	4	4
27	0,0010	5	6
30	0,0012	6	7
33	0,0014	7	8
36	0,0016	9	10
39	0,0019	10	11
42	0,0022	12	13
45	0,0025	13	15
48	0,0028	15	17
51	0,0032	17	19
54	0,0035	19	21
57	0,0039	21	23
60	0,0044	23	25
63	0,0048	25	28
66	0,0052	27	30
69	0,0057	30	33
72	0,0061	32	36
75	0,0067	35	39
78	0,0072	38	42
80	0,0075	40	44
82	0,0079	42	46
85	0,0085	45	49
88	0,0090	48	52
90	0,0095	50	55
92	0,0099	52	57
95	0,0105	55	61
98	0,0111	59	65
100	0,0116	61	67
102	0,0121	64	70
105	0,0128	67	74
108	0,0134	71	78
110	0,0139	74	81
112	0,0144	76	84

- Theoretical data for fresh water at 68ºF
- For the couplings, it is considered an extra 10% friction loss (8 connections per mile)

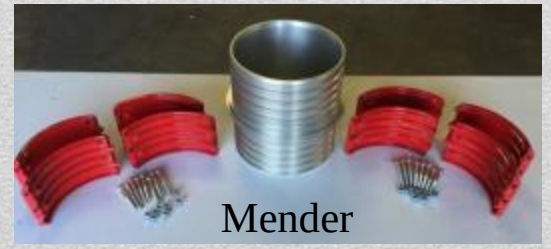
Hammerhead Couplings

- The only coupling allowed by many companies

- Hold & protect far better than any other coupler

Reusable Couplers (Field Installable)

- 4 clamp configuration:
  - Ease of installation
  - Superior radial pressure distribution
- Interlocking fingers
  - Prevents hose pinch and leaks
  - Holds better
- Locking lug:
  - Perfect alignment
  - Secure attachment to nipple
  - Prevents hose bite from coupler due to end pull
- Hose inspection port



Mender

Avoid Problems caused by poor quality couplings

Hammerhead Coupling Specs

Field Installable Couplings:

- Extruded Aluminum nipple is machined to shape - stronger than cast Aluminum
- 4 clamp segments distribute pressure evenly, prevent hose damage
- A5 aircraft grade bolts don't bend and stretch to prevent coupler from loosening with time
- Interlocking fingers prevent hose pinch & provide superior radial pressure distribution
- Locking lug ensures perfect alignment and prevents clamp slippage
- Chemical resistant options: FracGard coated, hot dip galvanized carbon steel, stainless steel

Victaulic Couplings	ID (in)	OD (in)	Length (in)	Weight (lbs)	Working Pressure (psi)
Field Installable 6"	5.25″	8″	6.25″	6	300
Field Installable 8"	7"	10"	6.75"	14	275
Field Installable 10"	9"	12"	7.625"	22.3	250
Field Installable 12"	11"	14"	9.125"	30.4	200

Chemical Resistant options

* All measurements are per hose end

Pigging can be the most dangerous part of water transfer

Make sure you use quality pigging equipment and have proper training

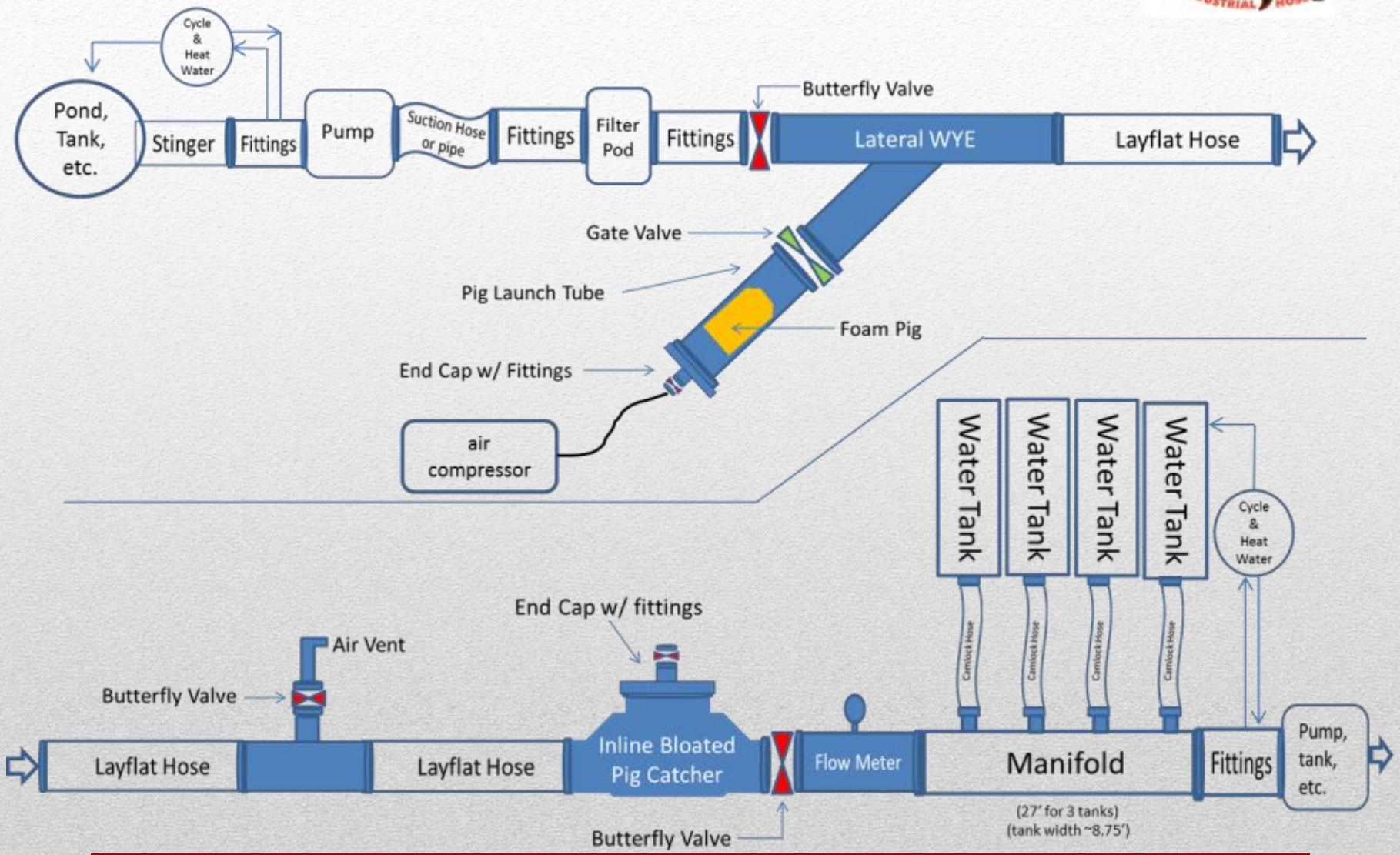
Pigging Equipment

pop-off valve for safety

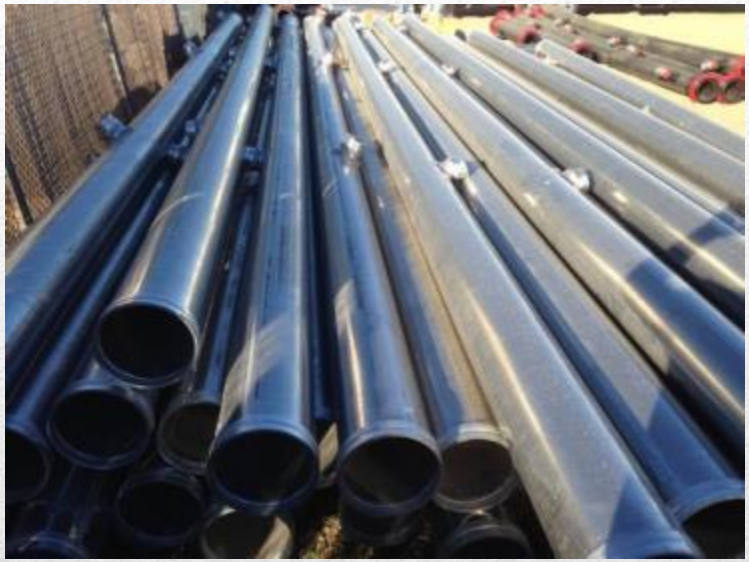
Proper gasket Material

Pigging System: from launcher → to catcher

Water Transfer Diagram



Manifolds, Fittings, Filter Pods, Valves, etc.



Custom Fab Shop

for custom fittings of any kind

Aluminum,
Galvanized Steel,
Poly Pipe

Suction and Specialty Hoses

wide variety available, popular examples below

Heavy Duty PVC Fabric Reinforced
Suction & Discharge Hose

150 PSI EPDM
General Purpose Water S&D Hose

Heavy Duty PVC Fabric Reinforced
S&D Hose w/ High UV Resistance

2,500 PSI Bulk Hose

Crimped fittings on any hose up to 12” diameter

Hammerhead Retrieval Systems

Tugger Trailer System

Reel Based System

<u>Tugger Trailer</u>: ideal when accessible via truck w/ trailer

- Retrieve up to 1 mile of hose with all connectors in tact
- Lay down up to 1 mile of hose in 30 minutes

<u>Reel System</u>: ideal for rough or sensitive terrain

- Hydraulic driven direct drive can attach to skid steerer or telehandeler
- Each Reel holds a 660 ft segment of hose

Many companies use a combination of Tugger Trailers and Reel Systems

Service & Training

MOBILE CRIMP SERVICE
713.466.5202

Highest Quality hose on the market

Chemical Resistance

High Pressure

High Temperature

…The future of water transfer

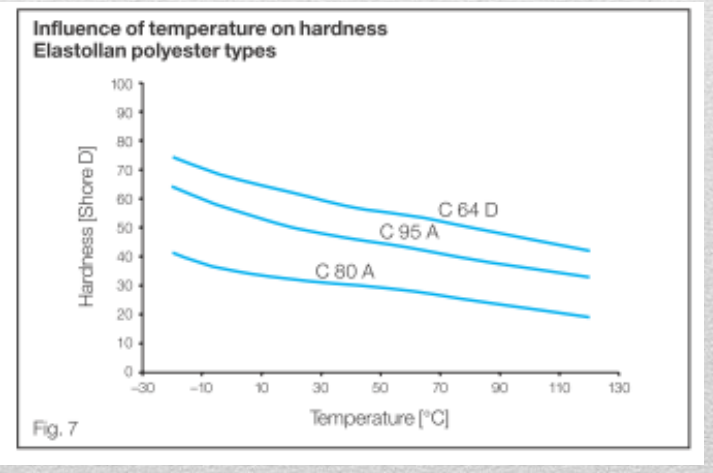
High Temperature, Chemicals

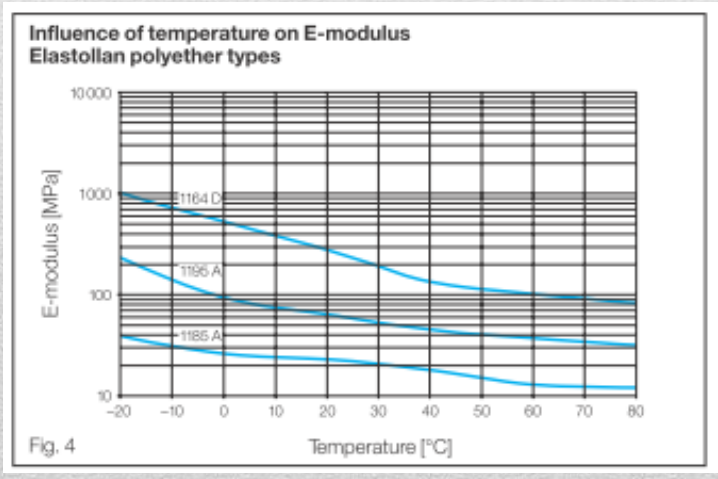
BASF Specs:

- Chemical resistance of polyurethane hoses and composite hoses sleeved with polyurethane. The polyurethane is not recommended for continuous use in contact with water above 40°c (or solutions containing water above 40°c) because of its hydrolising effect. Hydrolysis can also occur with long exposure to:

a) high humidity at elevated temperatures,
b) acid and alkali solutions,
c) aerated water,
d) fungi and bacteria.

Research shows how High Temperature weakens polyurethane





Chemical Resistance of Polyurethane
BASF Specs:

Acids and alkaline solutions

Elastollan products are attacked by concentrated acids and alkaline solutions even at room temperature. Any contact with these substances should be avoided. Elastollan is resistant to short-time contact with dilute acids and alkali solutions at room temperature.

Chlorine, etc. should be avoided with Polyurethane

	Concentration	Plasticised PVC (PVC-P) 20°C	Plasticised PVC (PVC-P) 60°C	Nylon 20°C	Nylon 60°C	Polyester Elastomer Lining 20°C	Polyester Elastomer Lining 60°C	Polyethylene Low Density, LDP 20°C	Polyethylene Low Density, LDP 60°C	Polyurethane 20°C	Polyurethane 60°C
chlorine	10% (dry gas)			✖	✖	✖*	✖*				
	100% (dry gas)			✖	✖	(Dry & Wet)	(Dry & Wet)	✖	✖	✖	✖
	10% (moist gas)										
chlorine trifluoride		✖*	✖*								
chlorine water	2%			✖	✖			✔	✔	✖	✖
	Sat. solution	■	✖*					✔	✖		

✔ Satisfactory

■ Some attack or absorption: the material may be considered for use when alternative materials are unsatisfactory and where limited life is acceptable. When PVC is to be used with such chemicals fullscale trials under realistic conditions are particularly necessary.

✖ Unsatisfactory: so rated because of decomposition, solution, swelling, loss of ductility etc. of the samples tested.

Hot Water and Polyurethane (TPU) lay flat hose:

- TPU has good physical durability, but vulnerable to hot water and some chemicals
- Durability and resistance to hot water & chemicals are dependent on quality of TPU
- Additives can make TPU hose more resistant to UV, but not heat or chemicals

Summary of guidance from working with TPU manufacturers and lay flat hose manufacturers:

- Polyurethane (TPU) hose holds up well for continuous use with water up to 122 °F
- As water exceeds 122°F, reduce working pressure to 60% of working pressure at 167°F
- Maximum water temperature should not exceed 167°F
- It's best to limit time that TPU is exposed to water above 122°F
- Some chemicals in produced, flow back, or treated water can break down polyurethane
- Combination of hot water and chemicals are compounded to weaken polyurethane further

Hot water accelerates hydrolysis in TPU (water molecules react with the TPU which reduces strength & integrity of TPU). Hydrolysis of TPU occurs with extended exposure to:

- High temperature water (as water temperature increases, hydrolysis increases)
- Acid and alkali solutions
- Aerated water
- Fungi and bacteria

Hot Water and Nitrile Rubber lay flat hose:

- Nitrile Rubber lay flat hose is more resistant to heat and chemicals.
- Durability and resistance to heat & chemicals are dependent on quality of rubber
- Additives can make rubber hose more resistant to UV, as well as heat & chemicals
- Proper curing of rubber is critical for durability and resistance to heat & chemicals
- Quality nitrile rubber can be used with water up to 176 °F and/or has chemicals in it
- Hot water & chemicals can damage hose with time and hose should be monitored

Trade off when choosing lay flat hose:

- *High quality Polyurethane (TPU) hose is physically more durable*
- *High quality Nitrile Rubber hose is more resistant to chemicals and heat*

Special Rubber Formulation

makes **Oroflex 20** more chemical resistant than any other hose

All Oroflex hose has a serial number for tracking and quality control

Hammerhead's Oroflex 20 special formulation makes it the most chemical resistant.

(the materials and processes used to make this hose the best on the market are patented)

Photo of: Polyurethane hose with chemical corrosion

Chemicals in produced water are very corrosive to couplers and other fittings

FracGard coated

Chemical Resistant Options

Hot Dip Galvanized

Several things give lay flat hose a black eye:

- False claims about lay flat hose quality & capabilities
- Problems caused from using the wrong or poor quality equipment
- Problems caused by poor planning, poor processes, poor training

FracGard green coating Chemical Reisistant Tests

The FracGard system has been tested for a period of two years in the chemicals listed below. Testing was conducted at temperatures averaging 75ºF and, unless specifically noted, There was no effect on the FracGard system.

ACIDS

Acetic Acid 25%	Muriatic Acid
Boric Acid	Nitric Acid 25%
Citric Acid 25%	Oxalic Acid
Formic Acid 10%	Phosphoric Acid 50%
Hydrochloric Acid 15%	Sulfuric Acid 50%
Hydrofluoric Acid 40%	

ORGANIC LIQUIDS

Crude Oil*	Kerosene	Soap
Diesel Fuel	Linseed Oil	Toluol
Diethylene Glycol	Lubricating Oil	Triethylene Glycol
Dipropylene Glycol	Methyl Alcohol (softens)	Turpentine
Ethylene Glycol	Mineral Oil	Urine
Gasoline	Mineral Spirits	Vinegar
Avgas (Jet Fuel)	Motor Oil	Water (Distilled)
Glycerine	Naphtha	Water (Salt)*
Heptane	Octane	Water (Fresh)
Hexane	Pentane	Xylol
Hexylene Glycol	Propylene Glycol	Formaldehyde
Isopropyl Alcohol	Sewage	Natural Gas

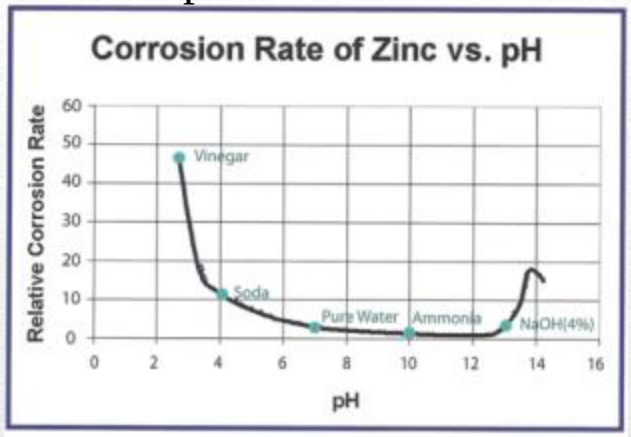
INORGANIC COMPOUNDS

Aluminum Chloride	Magnesium Hydroxide	Potassium Sulfate
Aluminum Hydroxide	Magnesium Nitrate	Silver Nitrate
Aluminum Nitrate	Magnesium Sulfate	Sodium Chloride
Calcium Hydroxide	Mercuric Chloride	Sodium Hydroxide
Calcium Sulfate	Potassium Bicarbonate	Sodium Nitrate
Calcium Nitrate	Aluminum Phosphate	Sodium Sulfate
Caustic Potash	Barium Chloride	Sulphur
Copper Nitrate	Calcium Chloride	Zinc Chloride
Ferric Sulfate	Potassium Chloride	Zinc Sulfate
Ferric Nitrate	Potassium Hydroxide	
Magnesium Chloride	Potassium Nitrate	

- In addition to the above ambient temperature tests, the FracGard system has been tested satisfactorily at 4,000 psi and 250ºF in oil and salt water mixtures simulating crude oil production conditions found in wells of moderate depth.

Hot Dipped Galvanized coating (ASTM: A 123 certified)

pH Resistance



Galvanized vs. Epoxy coated

Hot-Dip Galvanized Rebar	Performance & Condition	Epoxy-Coated Rebar
No	Special Handling	Extensive
No	Subject to UV Damage	Yes
No	Touch-up After Placement	Yes
Equivalent to Black Bar	Overlap Length	Additional Steel Required
No	Holidays/Pinholes	Yes
Yes	Fabricate after Coating	Yes
Excellent	Bond to Concrete	Poor
No	Underfilm Corrosion	Yes
Yes	Cathodic Protection	No
Excellent	Abrasion Resistance	Poor
All	Installation Conditions	Temperature > 50 F

Chemical Resistance

Hydrocarbons
Benzene (benzole)
Toluene (toluole)
Xylene (xyole)
Cyclohexene
Petroleum ethers
Heavy naphtha
Solvent Naphtha

Alcohols
Methyl parafynol (methyl pentynol)
Morpholinoisopropanol
Glycerol (glycerin)

Halides
Carbon tetrachloride
Amyl bromide
Butyl bromide
Butyl chloride
Cyclohexyl bromide
Ethyl bromide
Propyl bromide
Propyl chloride
Trimethlyene bromide (1, 3-dibromopropane)
Bromobenzene
Chlorobenzene
Aroclors & Pyroclors (chlorobiphenyls)

Nitriles (cyanides)
Diphenylacetonitrile
p-chlorobenzglycyanides

Esters
Allyl butyrate, caproate, formate, propionate
Ethyl butyrate, sobutyrate, caproate, caprylate, propionate, succinate
Amyl butyrate, sobutyrate, caproate, caprylate
Methyl butyrate, caproate, propionate, succinate
Benzyl butyrate, sobutyrate, propionate, succinate
Octyl butyrate, caproate
Butyl butyrate, sobutyrate, caproate, propionate, succinate, titanate*
Propyl butyrate, isobutyrate, caproate, formate, propionate
Iso-Butyl benzonate, butyrate, caproate
Iso-Propyl benzoate, caproate, formate, propionate
Cyclohexyl butyrate
**and other unspecified titanates*

Phenols
Phenol
Cresols (mehtylphenols)
Xylenols (dimethylphenols)
Biphenol (dihydroxybiphenyl)
2, 4-dichlorophenol
p-chloro-o-cresol
Chloroxylenols

Amine and Amine Salts
Pyridine
Pyrrolidine
Methylpiperazine
Dicarbethoxypiperazine
1-benzhydryl-4-methylpiperazine
2-4-diamino-5-(4-chlorphenyl-6) ethlpyrimidine
Hydorxyethylmopholine (hydroxyethyldiethylenimideoxide)
p-aminobenzenesulphonylguanidine
Butylamine oleate
Piperazine hydrochloride monohydrate
Carbethoxypiperazine hydrochloride (dry)

Amides
Formamide
Dimethylformamide

Miscellaneous
Glucose (liquid)
Benzilidenoacetone
p-chlorbenzopheone
Sodium azobenzensulphonate
Melamine resin solutions
Crude cascara extract
Creosote
Chloroflourocarbons

Problems with Cheap Hoses

Elongation: occurs when the inner fabric (jacket) is not woven optimally to minimize elongation. A properly woven hose jacket should elongate no more than 2%. Cheap hoses often elongate by as much as 12% at working pressure; this causes severe snaking. Snaking across an abrasive surface can tear the outer coating. Severe snaking can push hose onto a road or to roll down a hill. Elongation is relaxed after pressure is released.

Expansion: all lay flat hose will expand some when the hose is pressured up. Extreme expansion occurs when inner fabric is not woven optimally. The fabric weave is what gives the hose it's strength and it is also what prevents the hose from elongating and expanding. Too much hose expansion makes it hard to pig a line effectively and it also puts too much stress on the hose where they meet couplings, which can damage the hose.

Burst at low pressures: There are no standards for lay flat hose larger than 6" diameter. It is common for manufacturers to claim working pressures of 200 psi even if their burst pressures are not much higher than the claimed working pressure. Pressure testing has proven several manufacturers hose to burst with too little margin for safety.

Delamination: when the outer and/or inner lining separates from the woven jacket. This compromises the strength and integrity of the hose and can cause it to burst more easily, leak, and make it much harder for the coupling to have good retention on the hose. Delamination is caused when hose manufacturers cut corners by: laminating the inner and outer liners onto the jacket instead of extruding through the weave, by using cheap raw materials, or by doing a poor job in the curing process. It is common for low cost manufacturers to use cheap raw materials and to significantly reduce curing times.

Leaks within a few feet of the Coupling: are often caused when the coupling damages the inner lining of the hose, which causes water to leak into the fabric woven jacket until it finds a weak place in the outer lining to leak out. Several things may cause this: sharp edges on the coupler nipple grooves or overtightening the couplers retention bolts which hold the coupler to the hose; bot situations can cause a "bite" into the inside of the hose.

(Poor quality hose or poor quality couplers can force you to tighten the bolts extra tight to keep the coupling from coming off or slipping or leaking.)*

*High quality couplings will hold even poor quality hose securely without damaging it, even at pressures well above the burst pressure of the hose.

Cheap hoses fail because:

- Use of cheap materials.
- Cut corners on production of the hose.

Results: hose that looks fine when new, but don't meet specs and have many problems

(problems illustrated below and on next page)

Delaminating

Blistering

Flaking from UV exposure

Cheap Hose problems continued:

Snaking

Burst at low psi

Chemical Deterioration