

GLIS

Great Lakes Industrial Solutions, Inc.

(330) 635-0272

Sales@GLISinc.com

www.GLISinc.com

Partnering With



GLIS Presentation

Centrifugal and Static Casting



- Nearest sea port: Santos (100 km)
- Nearest international airport: São Paulo (15 km)

Where We Are

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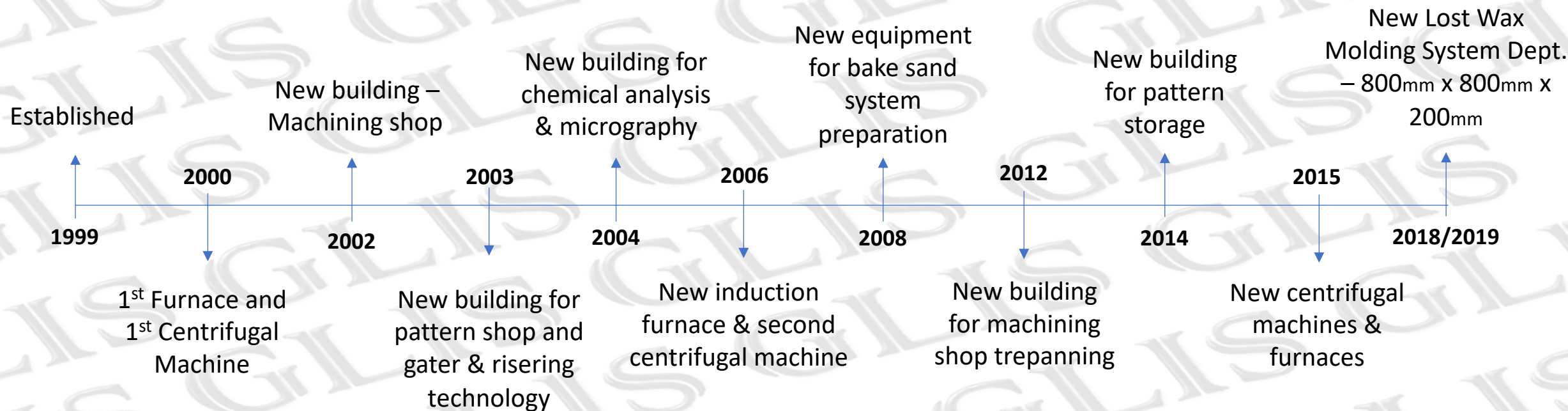
About

- Brazil - USA
- Founded: 1999
- Total plant area: 26.000 m²
- 12.000m² covered área
- Employees: **156** - 2016
- Annual Gross Revenue – 16 m.€ / year
- Specialized on static and centrifugally casting stainless steels and super alloys (Ni and Co based alloys)

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Milestones



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Facility Diagram



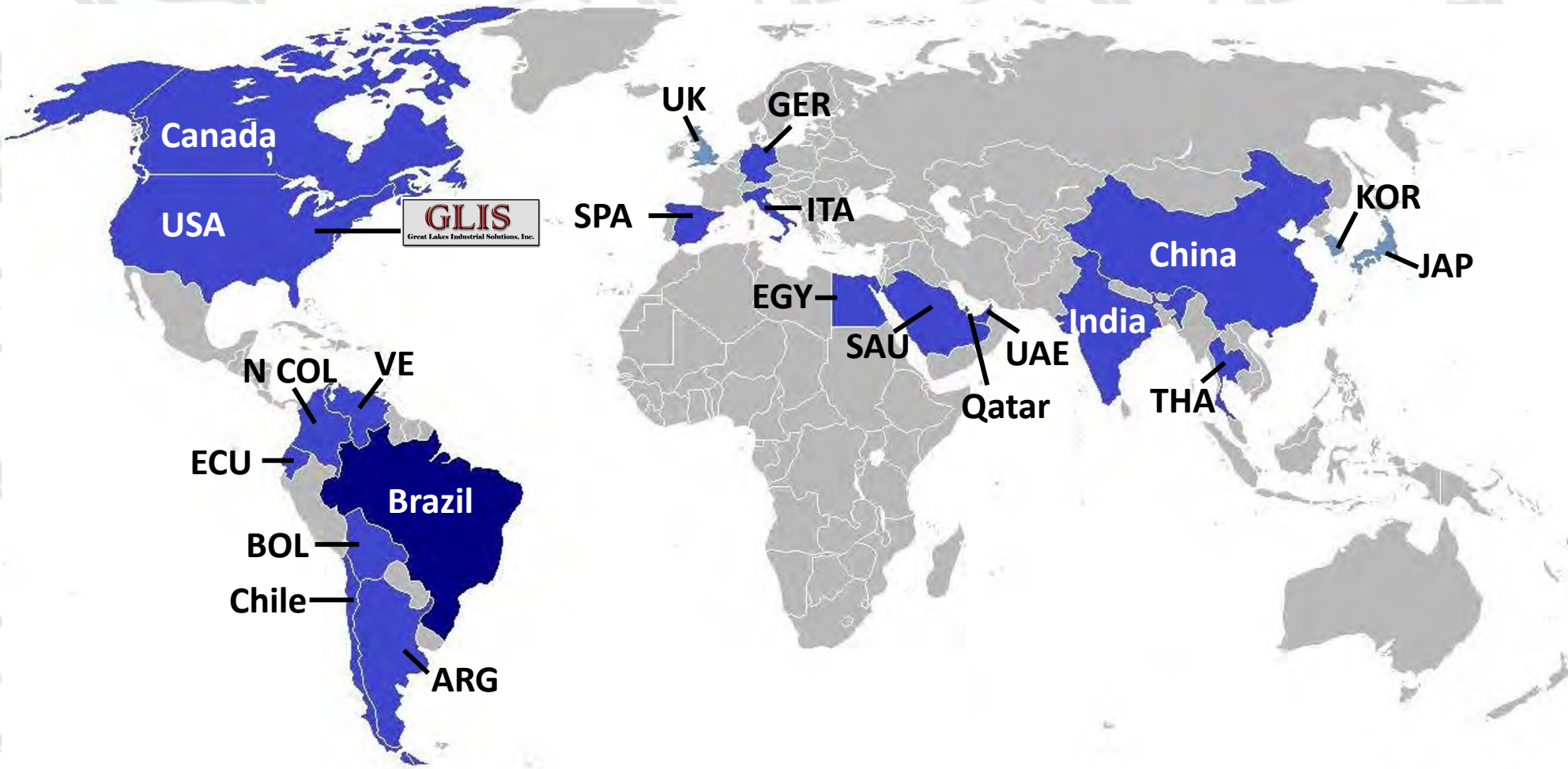
Diagram Key

1. Foundry Static & Centrifugal
2. Grinding & Assembling
3. Pattern, Gatering, & Risering
4. Machining Shop
5. Foundry Centrifugal

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GLIS Location & Operations



Color Key

- Headquarters
- Direct Exports
- Indirect Exports



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Featured Products

BLAST FURNACES

- Blow pipes for blast furnaces – complete with refractory
- Stock house screens
- Fixed & movable armor plats – double bell & paul whurt system
- Casted screens for sintering & pelletizing plants

CONTINUOUS CASTER

- Bimetallic & standard rolls for continuous casters

MILL STANDS – HOT & COLD STRIP MILLS

- Riders & skids complete assembled for hearth walking beam furnace
- Rollers table for skin pass lines
- Looper rolls for hot strip mills
- Run out table rolls for hot strip mills – special performance warranty
- Wrapper rolls for steel coilers
- Bimetallic deflector rolls for cold strip mills

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Featured Products

CONTINUOUS GALVANIZING & ANNEALING LINES

- Rolls – coated & uncoated from 100 to 1.50mm OD all alloys – engineering – design & fabrication
- Radiant Tubes – double “P” shape included – engineering – design & fabrication
- Galvanizing – sink – stabilizing – correction rolls
 - Made in special 100% ferrite free alloy – special groove design
- Bushing & sleeves for galvanizing rolls & arms made in stellite #6, OR triballoy T-800 – special & exclusive precision casting process unicast, similar to lost wax
- Radiant tube supports all shapes and design

STEEL WORK PLANTS, MINI MILL, CSP COMPACT STRIP MILL PLANTS

- Wet & dry rolls for tunnel furnaces
 - Special design
 - High nickel
 - High tungsten trade made materials
 - Temperature application until 1.190°C
 - Engineering design & fabrication

The logo for Great Lakes Industrial Solutions, Inc. features the letters "GLIS" in a large, bold, serif font. The letters are a dark red color with a white outline and a slight shadow effect, giving them a three-dimensional appearance. The logo is set against a light gray background within a black-bordered box.

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Featured Products

AUTOMOTIVE PLANTS

- Fixtures / Trays / Baskets
 - Special & efficient custom-made designs & alloys radiant tubes (instead of fabricated)
 - Special design & alloys allow for Low Oxidation and High Performance
- Retorts for endogas reactor generators
- Muffles & retorts for shaker & rotary furnaces
 - Heat treatment for bearing bodies
- Special fixtures for vacuum furnaces using alluminides alloys

CEMENT PLANTS

- Wear plate for all kind of applications made in high chrome & manganese alloys
- Grates for all brands (FL Smidth, Polisius, shapes for cement cooling chambers)
- Support for grates for all brands for cooling chambers

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Featured Products

MINERAL PLANTS

- Casted screens for sintering & pelletizing plants
- Centrifugally casted rolls for roller screens from 60 to 250mm for pelletizing plants
- Grate bars for sintering & pelletizing cars
- Lateral plates for sintering & pelletizing cars



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Centrifugally Casting

- Centrifugally tubes are made by spun casting. The advantage of the centrifugally cast tubes is the high purity of the Cr and Ni containing alloys. A certain amount of molten steel is filled into rotating molds.
- The high centrifugal forces press the liquid metal to the surface of the mold, and thus the tube shape is made.
- Due to the lower density of the impurities, they are concentrated in the inner side of the tubes and can be removed by pull-boring afterwards if required.
- Furthermore, by centrifugal casting the carbon content (0.4-0.5%) can be maintained higher as compared to drawn tubes (up to 0.1%)



Centrifugally Casting Operation



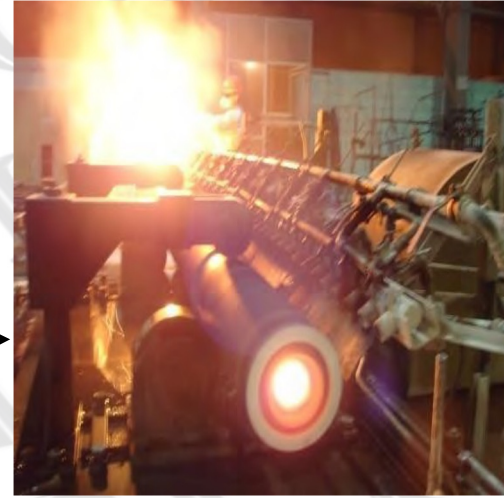
(A)

(A): Melting,
deoxidization &
desulfurization of the
alloy



(B)

(B): The liquid steel is
poured into the rotating
and pre-heated mould



(C)

(C): The liquid steel goes
to the end of the mould
and fills the entire inner
side of the mould

(D): The solidification
takes place inside the
mould, ending up in an
equally thick wall tube

(D)

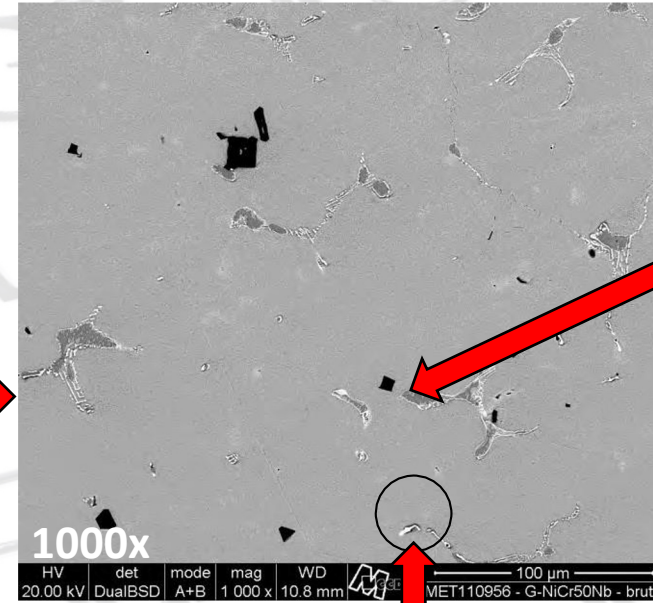
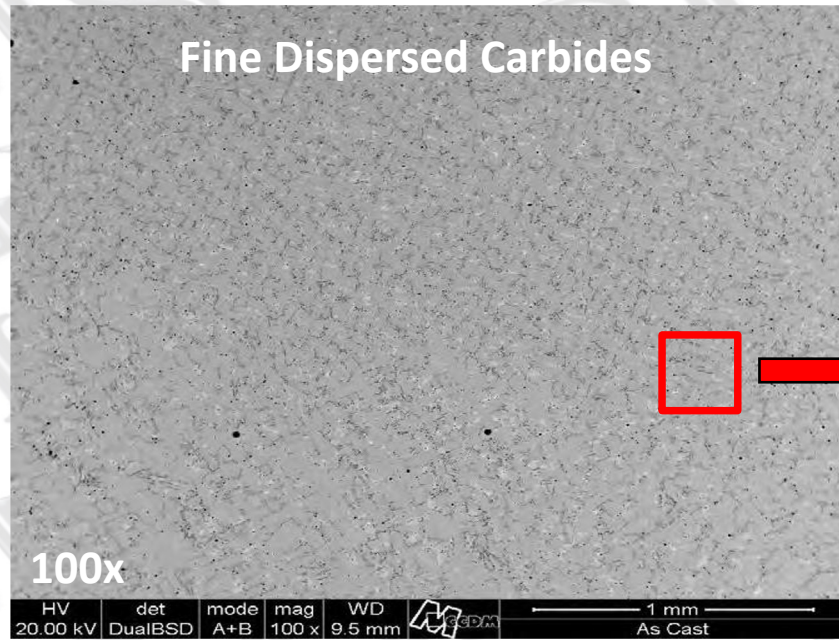


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Centrifugally Casting: Microstructure



Chromium Carbides

Niobium Carbides

- Already during casting of the tubes, a fine carbide (chromium and niobium carbides) network is formed. Secondary carbides can also be formed.
- After only a few hours at operating temperatures, additionally very-fine so-called secondary carbides are precipitated. This provides an excellent high temperature strength, which is essentially better than drawn tubes.

Radiant Tubes Assembly



- X-Ray
- Ultrasonic
- Other NDT (upon request)
- Hydrostatic Test
- Macrography
- Micrography (SEM & optical)
- Tensile Test (RT & high temp.)
- Creep Rupture

Fabrication stages, inspections, tests, and NDT:

- Tube Spun Fabrication
- Chemical Analysis
- Straightening
- Pneumatic Test
- Pull Boring (if required)
- Welding, Qualification WPS
- Dye Penetrant
- Boroscopy

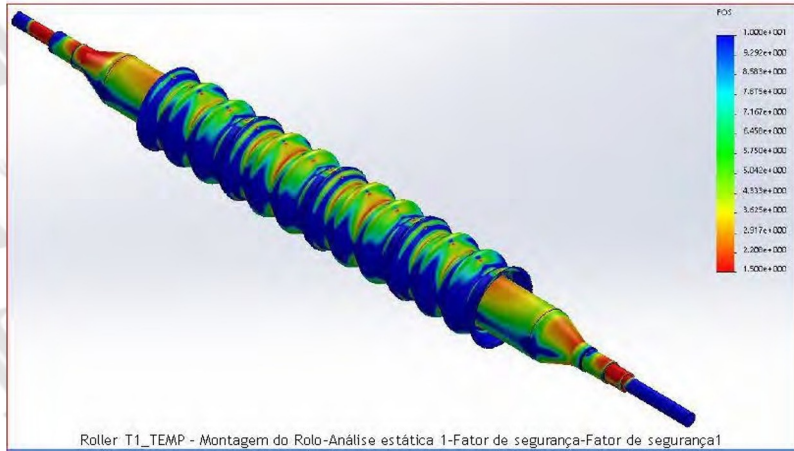
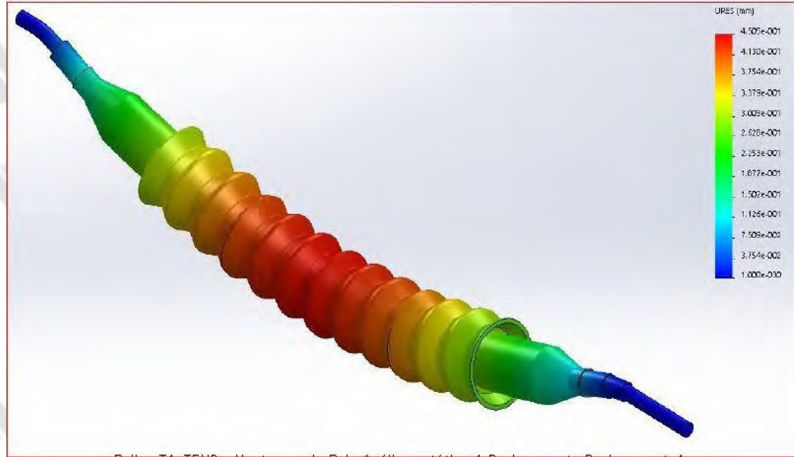


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Static Casting



- Employment of Solidcast and Flowcast modeling software for casting and flow simulations
- Employment of Autocad – inventor & Solid Works software in projects and manufacturing drawings
- FEA Finite Elements Mechanical Analysis & Engineering (Design & Fabrication) For:
 - Walking beam furnaces
 - Beams
 - Columns
 - Supports
 - Skids
 - Riders
 - Furnace rolls for CGL CAL lines
 - Hearth special tunnel furnace rolls
 - Fixtures for heat treatment surfaces
 - WET & DRY tunnel furnace rolls for Mini Mill CSP compact Strip Mill plants

Static Cast Parts

Weight Range: Castings up to 5500 lbs

Main Grades:

- Stainless steels: all grades
- Corrosion resistant alloys: all grades
- High temperature resistant alloys: all grades
- Special high alloys
- Nickel, Cobalt, Tungsten – Base alloys
- Aluminides alloys for vacuum furnaces

Reverse Engineering

Retro fit FEA Finite Elements Analysis Technology



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Materials

According to Standards:

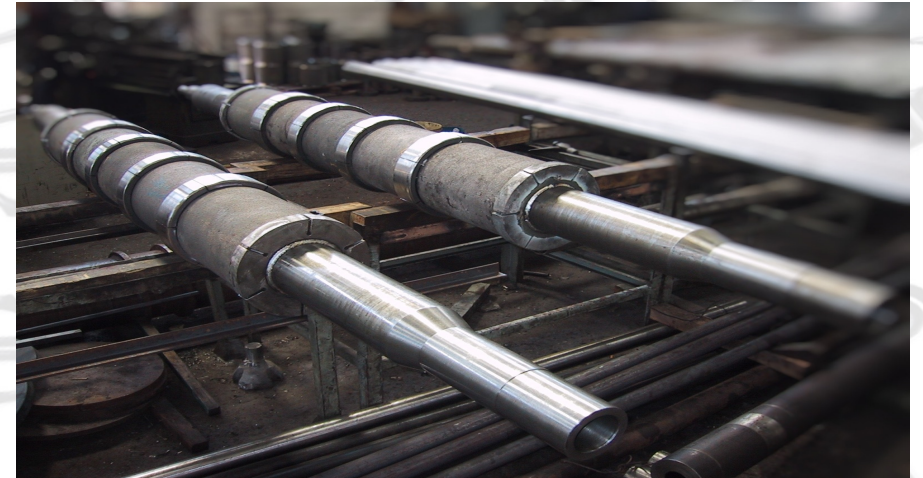
- ASTM A447 TPII
- ASTM A351 HK40
- ASTM A297 ALL GRADES
- HP mod. Nb or (25Cr 35 Ni Nb)

Proprietary Alloys:

- Static cast parts rolls radiant tubes
- Centrifugally cast parts (tubes)
- FAIALLOY-52 (20Cr 32 Ni Nb)
- FAIALLUM-100
 - For Vacuum furnaces with aluminum addition

Proprietary Alloys:

- For tires for wet rolls CSP plants
- For dry rolls for CSP MiniMill plants
- FAIALLOY – HTCR
 - (28Cr-50Ni-16W-1Nb-MA)
- FAIALLOY – HP MODIFIED
 - (Cr25-35Ni-E2535Nb-MA)



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Proprietary Alloys

Developed:

- FAIALLOY – HRTCAS – W – MM
 - (28Cr-50Ni-16W-1Nb-MM)
- FAIALLOY – HP MODIFIED
 - (Cr25-35Ni-E2535Nb-MA)
- FAIALLOY – 52 (20Cr32NiNb)

In Development:

- FAIALLOY-70MM
 - (28Cr42NiNb+MM)
- FAYALLOY-70ALTM
- FAYALLOY-75-ALTM
 - (30Cr45NiAlNb+MA)

Developing a Proprietary Alloy:

- Alloy goals (creep, carburization, oxidation)
- Project and development planning
- 20 stages



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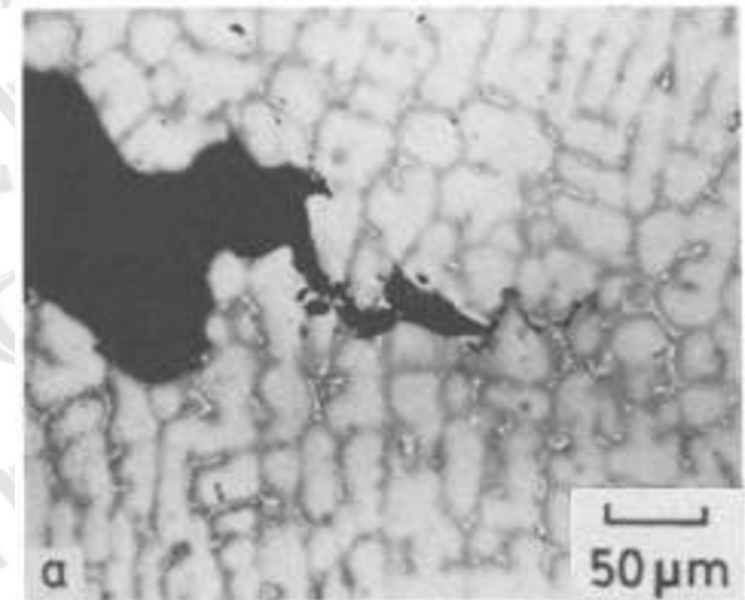
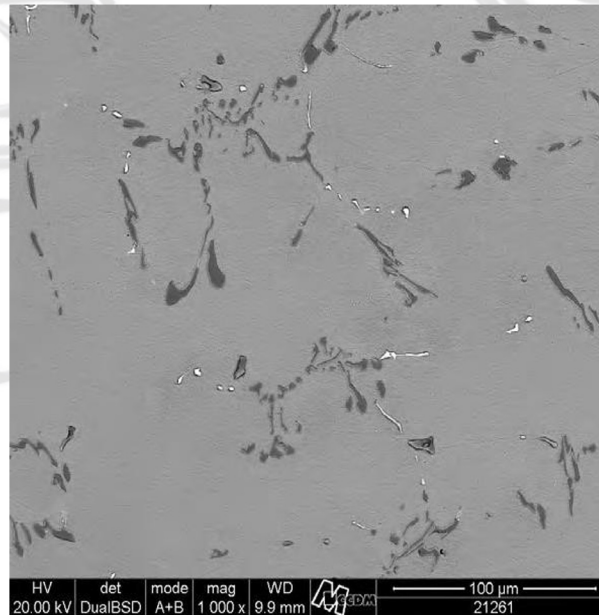
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Micro Materials (MM)

Micro Materials:

- Intentional minor material additions to enhance creep properties
- Creep resistant enhancer elements:
 - Cr, Nb, Ti, & Zr (carbides formers)
- Carbides make the creep crack propagation more difficult



Alloy Types

FAI	ASTM - 297	AISI	C %	Cr %	Ni %	Mn %	Si %	Mo %	Temp °C
FAI - 1	HC	446	0,5	28	-	1	2	-	1160
FAI - 2	HD	327	0,4	27	5	1,5	2	-	1120
FAI - 3	HE	312	0,5	28	9	2	2	-	1130
FAI - 4	HF	-	0,4	18	8	2	2	-	1130
FAI - 5	HH	309	0,5	25	12	2	2	-	1050
FAI - 6	HI	-	0,35	26	14	2	2	-	1060
FAI - 7	HK	310	0,45	25	20	2	2	-	1100
FAI - 8	HL	-	0,5	30	20	2	2	-	1180
FAI - 9	HN	-	0,45	20	25	2	2	-	1050
FAI - 10	HP	-	0,45	25	35	2	2	-	1100
FAI - 11	HT	330	0,45	15	35	2	2	-	1080
FAI - 12	HU	-	0,45	18	38	2	2	-	1120



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Alloy Types

FAI	ASTM - 743	AISI	C%	Cr %	Ni %	Mn %	Si %	Mo %	Temp °C
FAI - 13	CA-6N	-	0,06	11	7	0,5	1	-	-
FAI - 14	CA-6NM	-	0,06	13	4	1	1	0,6	-
FAI - 15	CA-15	410	0,15	13	1	1	1,5	0,5	-
FAI - 16	CA-40	420	0,3	13	1	1	1,5	0,5	-
FAI - 17	CB-30	-	0,3	20	2	1	1,5	-	-
FAI - 18	CB-7Cu-1	-	0,07	16	4	0,7	1	-	-
FAI - 19	CB-7Cu-2	-	0,07	15	5	0,7	1	-	-
FAI - 20	CD-4MCu	-	0,04	25	5	1	1	1,8	-
FAI - 21	CF-3	304L	0,03	19	10	1,5	2	-	-
FAI - 22	CF-8	304	0,08	20	9	1,5	2	-	-
FAI - 23	CF-3M	316L	0,03	19	11	1,5	1,5	2	-
FAI - 24	CF-8M	316	0,08	19	11	1,5	2	2	-
FAI - 25	CG-6MMN	-	0,06	22	12	5	1	2	-
FAI - 26	CG-8M	-	0,08	20	12	1,5	1,5	3	-
FAI - 27	CH-20	309	0,2	24	14	1,5	2	-	-
FAI - 28	CK-20	310	0,2	25	20	2	2	-	-
FAI - 29	CN-7M	-	0,07	21	29	1,5	1,5	2	-
FAI - 30	CF-8C	347	0,08	20	11	1,5	2	-	-

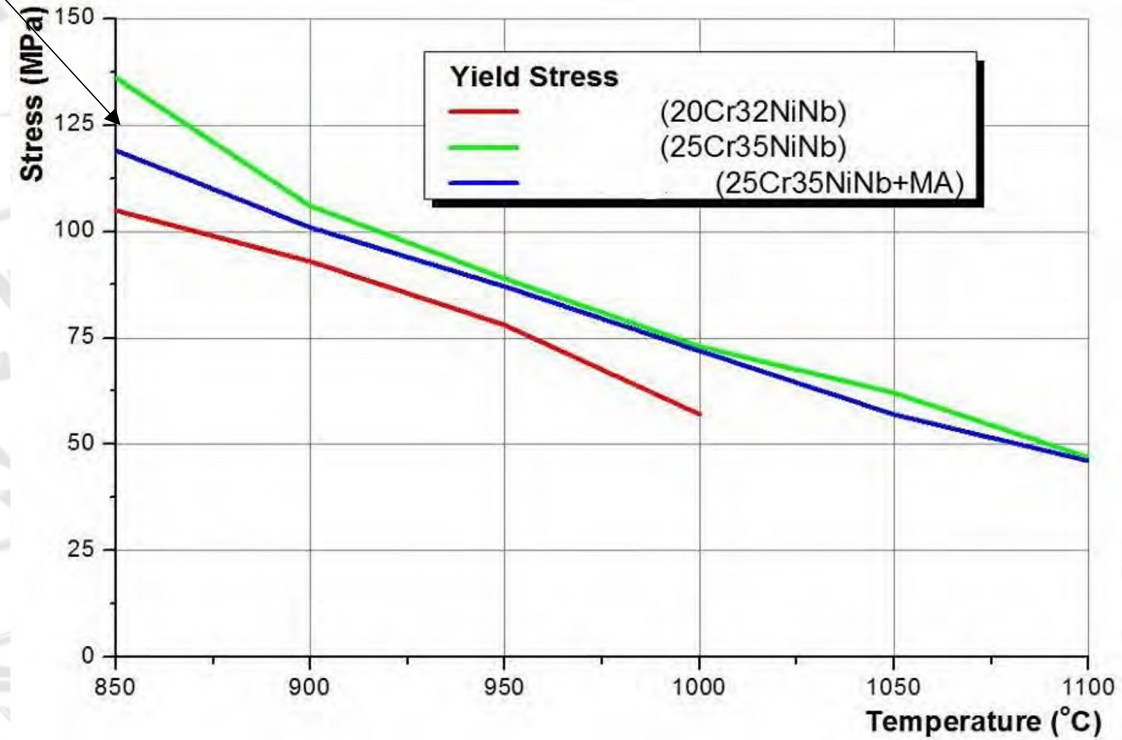
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- Short time Tensile Test at elevated temperatures
- Cap. 10 ton
- Maximum temperature – 1.200°C
- ASTM E21 / ISO 783

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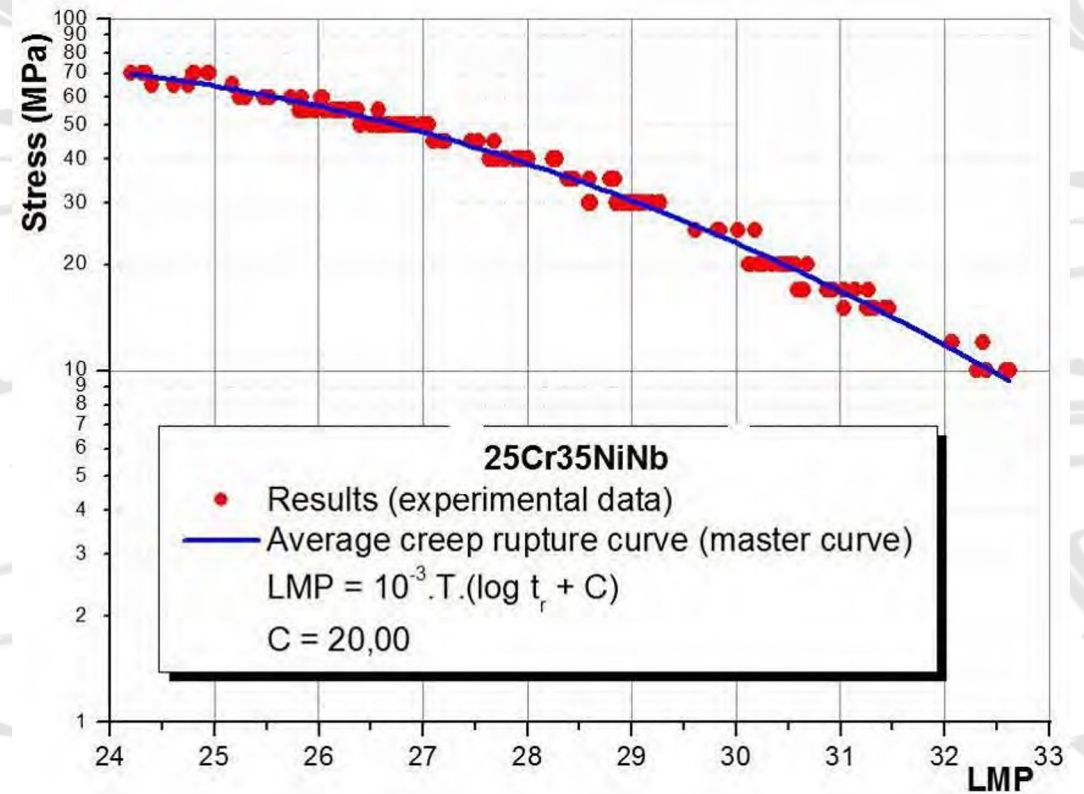
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FAI Alloy -70 (25 Cr 35 Ni Nb+M M)

- Up to now 124 tests performed (since 05)
- Temperature: between 750°C & 1150°C
- Stresses: between 10 & 70 MPA
- Rupture Time: between 5 & 15,000 hours



- 90 Creep testing machines available at external associated laboratory
- Constant load type
- Temperature up to 1200°C
- ASTM E139 / ISO 204

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Creep Test Facilities



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Centrifugal Foundry



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Centrifugal Foundry

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Centrifugal Foundry



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Induction Furnaces for Static Castings



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Static Castings



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Lost Wax Process



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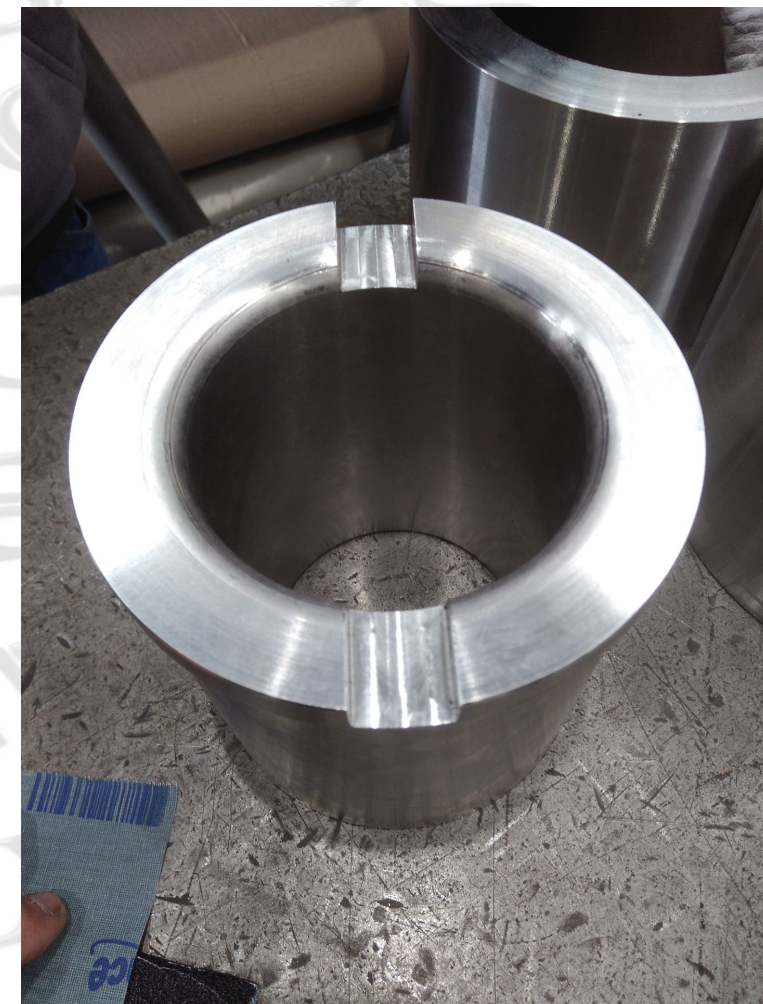


Lost Wax Process: Electrical Elements

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Bushing Sleeve: Foen Design Faigalvadur-EH



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Machining Shop



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Spectrometer ARL Last Generation



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Complete Metallurgical Laboratory



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Complete Last Generation Faro Tasteator Measurement



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Trays For Vacuum Furnaces: Fiat Termoli Italy Faiallum-100



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Trays For Vacuum Furnaces: Fiat Termoli Italy Faiallum-100



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Trays For Vacuum Furnaces: Bosch Modugnoitaly Faiallum-100



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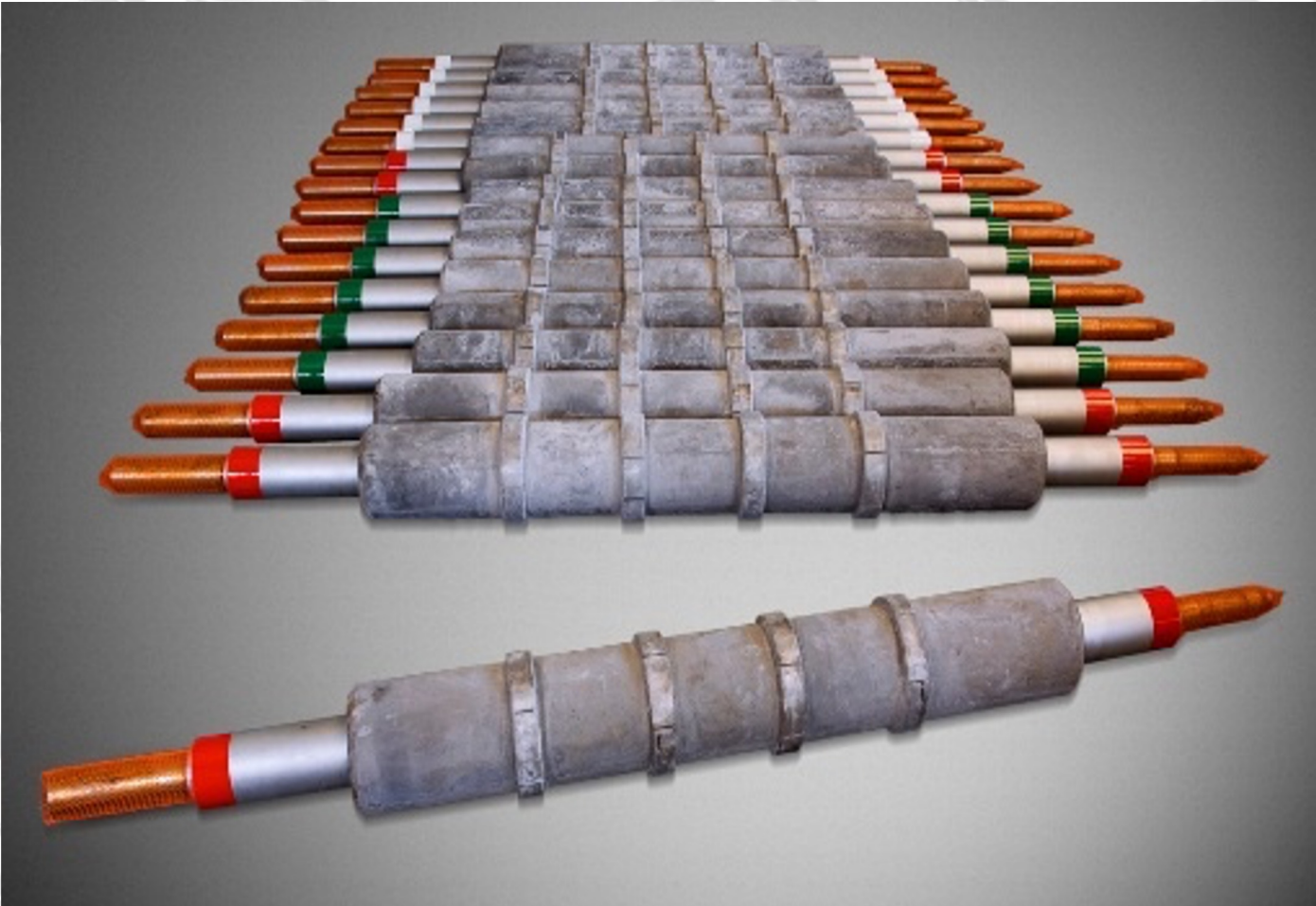
Entry Exit Rolls For Walking Beam Furnaces



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Wet Rolls For Tires



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Our Partnerships



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FEDERAL DO
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Partnerships Continued



ArvinMeritor



Mercedes-Benz



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Quality Certifications

- ✓ AD 2000 Merkblatt W0 – TÜV Nord
- ✓ BV Mode II – Bureau Veritas
- ✓ CRCC 25764 Petrobras
- ✓ Hydrostatic & Performance Test in PSR Valves
– American Bureau of shipping
- ✓ ISO 9001:2016 – SGS
- ✓ NB PSR Valves Certification – National Board
of the USA
- ✓ PED 97/236/EC – TÜV Nord

Prizes & Recognitions

- ✓ Foundry of the Year 2004, 2008 & 2012 by
ABIMAQ
- ✓ Quality of Service 2006 by SESI
International Exhibitions in Brazil, Germany, &
USA
- ✓ PSR Valve Supplier of the Year 2011 by ABIMAQ
- ✓ Tube Supplier of the Year 2010 by ABIMAQ
- ✓ Excellence Program 2003 by ABIMAQ

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