Products & know-how

Solutions for the Direct Reduction Industry

Schmidt + Clemens Group

Schmidt + Clemens is the market leader in centrifugally cast tubes for the Direct Reduction Industry, thanks to the trust of many customers around the world, which has allowed us to provide more than 45000 tube assemblies since 1986. Our leading position is the result of:

- High metallurgical product quality, ensured by our stringent quality systems, which constitutes the basis for achieving the required product performance and lifetime.
- Highly efficient manufacturing methods including unique melting, machining and welding techniques, as the result of a major ongoing investment programme in manufacturing development.
- Product improvement boosted by specialists in our RDS department, who are responsible for developing new materials with the specific objective of meeting the most demanding operational requirements.
- Specially developed materials for Midrex® and HyL® processes have always been the core target of S+C. Since 2001 and more recently in 2004, the HT family of alloys for firebox temperatures up to 1185°C are improving performance and productivity of the DR plants.
- Customer service offered through our worldwide network of facilities.

Our high quality products, innovative developments and our complete range of services are the basis for our company objectives: complete customer satisfaction and confidence.

Why Schmidt + Clemens?

Enhanced reliability, longer service life

Products for Midrex® Reformers

New metallurgies were developed at Schmidt + Clemens. The main outcome observed was plant reliability improvement and lifetime extension of the tubes. The proprietary Centralloy® G 4852 Micro and Centralloy® G 4879 Micro materials were specially designed by Schmidt + Clemens for DR Reformer applications to meet the most stringent mechanical requirements and were already supplied since 2001.

Centralloy® 60 HT D has been designed for the operation of the reformer tubes up to a maximum firebox temperature of 1185 °C thus, resulting in a significant increase in plant productivity. This is based in a completely new metallurgy with superior oxidation and mechanical properties.

Our products and services at a glance

- Fully assembled reformer tubes
- Convection coils and recuperator bundles
- Accessories
- Specialised services such as monitoring or metallurgical support

Range of Alloys

Description				Chemical Composition								Most common application for Midrex® reformer tubes
No	Trade Mark Centralloy®	ASTM Type	Designation according to DIN EN 10027 Part 1	Approximate values in wt%								
				C	Si	Mn	Cr	Ni	Nb	W	Others	
1	**G 4852**	HP+Nb	GX40NiCrSiNb35-25	0.4	1.5	1.5	25	35	1.5	–	–	Bottom section
2	**G 4852 Micro**	HP+Nb (MA)	GX45NiCrSiNbTi35-25	0.45	1.5	1	25	35	1.5	–	+ Add.	Bottom section
3	**G 4852 Micro R**	HP+Nb (MA)	GX45NiCrSiNbTi35-25	0.45	0.8	1.5	25	35	1	–	+ Add.	Bottom section
4	**G 4879**	NA 22H/HV	G-NiCr28W	0.45	1.5	1.5	28	48	–	5	–	Top section
5	**G 4879 Micro**	NA 22H/HV (MA)	G-NiCrTi28W	0.5	1	0.75	28	48	–	5	+ Add.	Top section
6	**60 HT D**	–	–	0.45	–	–	27	Bal.	0.7	–	Fe, Al, + Add.	Top section

Solu

Features

Products for Midrex® Reformers

Chemical composition of alloys designed for Midrex® DR Reformers include:

- 0.4 – 0.5 wt% carbon and nickel higher than 35 wt% for mechanical resistance and structural stability at high temperatures.
- Chromium contents higher than 25 wt% for necessary oxidation resistance.
- Aluminium, which is used in Centralloy® 60 HT D as a source for oxide layers build-up against high temperature corrosion phenomena. Our Centralloy® 60 HT D constitutes the latest alloy development, unique in the world of centricast products.

Balanced compositions lead to material structures with optimised physical and mechanical properties.

Carbon content leads to the formation of:

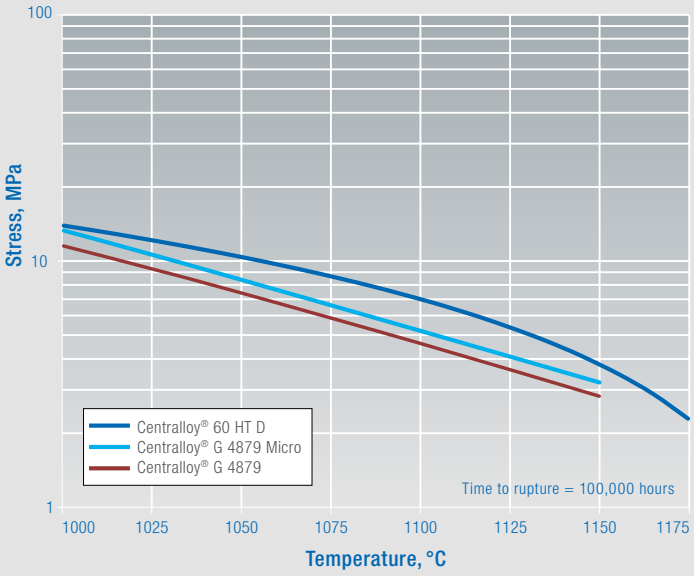
- Primary M_7C_3-type carbides during casting, which are transformed into $M_{23}C_6$ upon ageing.
- Secondary carbides of the $M_{23}C_6$- and M_6C-type during ageing.
- Primary and secondary niobium carbides.

Fine carbides precipitation results in improved high temperature mechanical properties including creep strength.

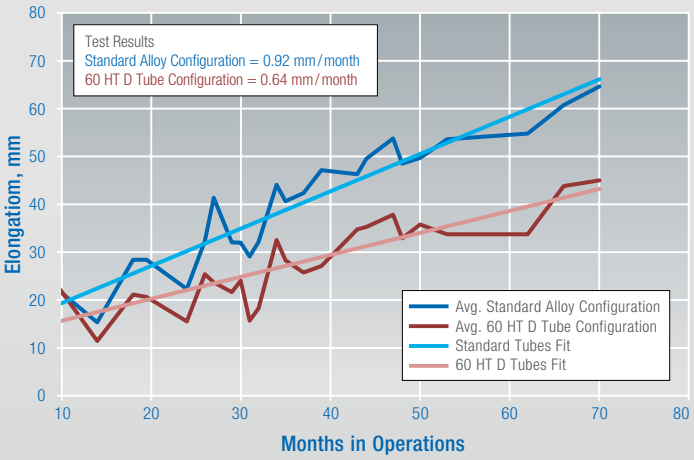
Further improvement is possible by the addition of strong carbide forming elements like titanium. Creep strength is increased by 15 – 20%. Because of the small amounts of carbide forming elements used, such alloys are called micro alloys.

Comparative Performance

Average Stress to Rupture vs. Temperature



Reformer Tube Elongation – follow up of Centralloy® 60 HT D Tubes



Highest requirement of reformer tubes is found in the top section material. In addition to a high creep strength able to withstand throughout the lifetime of the tubes, reduced elongation of the overall assembly is necessary to maintain dimensional stability of the tubes during operation to avoid hot bands.

tions for Midrex® Reformers

Able to meet even the highest demands

Products for HyL® Plants

Catalyst Tubes for HyL® Steam Reformer:
Centralloy® G 4852 Micro R is specially designed for steam reformer with the highest creep rupture strength, combined with excellent oxidation resistance.

Coils for HyL® Process Gas Heaters:
Centralloy® ET 45 Micro provides the best protection against metal dusting in PGH coils. Centralloy® HT E offers delayed coke deposition and the best carburisation resistance.
S+C provides the material selection for optimised PGH coil configuration.

Our products and services at a glance

- Reformer tubes
- Process gas heaters coils
- Convection modules
- Accessories
- Specialised services

Range of Alloys

Description				Chemical Composition								Most common application in HyL® plants
No	Trade Mark Centralloy®	ASTM Type	Designation according to DIN EN 10027 Part 1	Approximate values in wt%								
				C	Si	Mn	Cr	Ni	Nb	W	Others	
1	**G 4852**	HP+Nb	GX40NiCrSiNb35-25	0.4	1.5	1.5	25	35	1.5	–	–	Steam reformer tubes
2	**G 4852 Micro**	HP+Nb (MA)	GX45NiCrSiNbTi35-25	0.45	1.5	1	25	35	1.5	–	+ Add.	Steam reformer tubes
3	**G 4852 Micro R**	HP+Nb (MA)	GX45NiCrSiNbTi35-25	0.45	0.8	1.5	25	35	1	–	+ Add.	Steam reformer tubes
4	**ET 45 Micro**	–	GX45NiCrSiNb45-35	0.45	1.6	1	35	45	1	–	+ Add.	Preheater coils – Metal Dusting
5	**ET 45 LC**	–	GX13NiCrNb45-35	0.13	0.8	1.5	35	45	0.8	–	+ Add.	Preheater coils – Metal Dusting
6	**HT E**	–	–	0.45	–	–	30	45	0.5	–	Fe, Al, + Add.	Preheater coils – Coking, Carburisation

Features

Products for HyL® Plants

Chemical composition of alloys designed for HyL® products include:

- 0.4 – 0.5 wt% carbon and nickel higher than 35 wt% for mechanical resistance and structural stability at high temperatures.
- Chromium contents higher than 25 wt% for necessary oxidation resistance.
- Aluminium, which is included in Centralloy® HT E as a source for oxide layers build-up against coking and carburisation, for the best performance at high temperature.

Balanced compositions lead to material structures with optimised physical and mechanical properties.

Carbon content leads to the formation of:

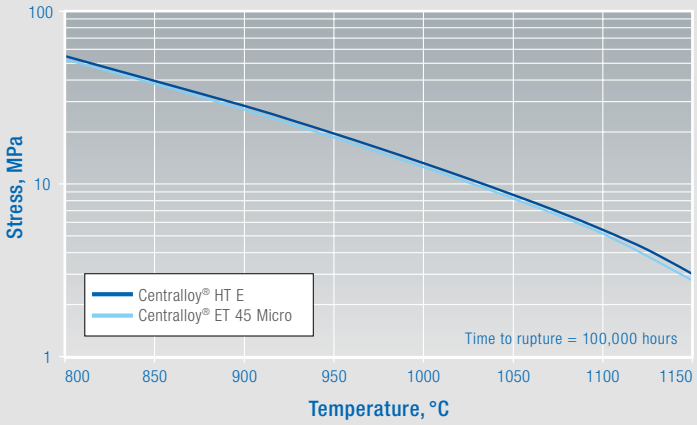
- Primary M_7C_3-type carbides during casting, which are transformed into $M_{23}C_6$ upon ageing.
- Secondary carbides of the $M_{23}C_6$- and M_6C-type during ageing.
- Primary and secondary niobium carbides.

Fine carbides precipitation results in improved high temperature mechanical properties including creep strength.

Further improvement is possible by the addition of strong carbide forming elements like titanium. Creep strength is increased by 15 – 20%. Because of the small amounts of carbide forming elements used, such alloys are called micro alloys.

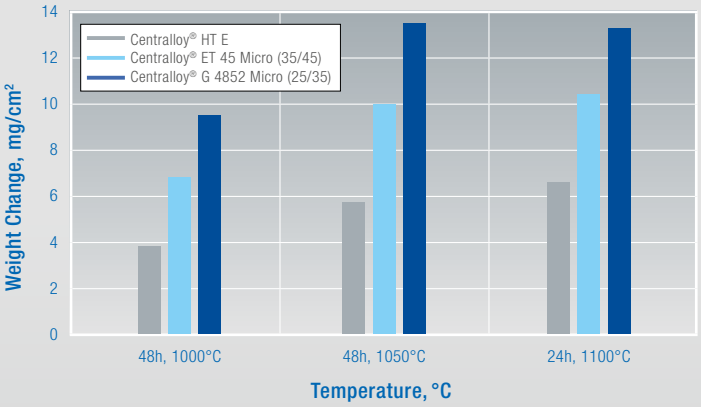
Comparative Performance

Average Stress to Rupture vs. Temperature



Centralloy® HT E combines an excellent oxidation, coking and corrosion resistance, together with significant creep strength for the operation in HyL® PGH coils.

Isothermal Carburisation in CH_4/H_2



Carburisation in absence of any protective oxide scale. Higher resistance to carburisation and coking of Centralloy® HT E, allows material to withstand severity of PGH coil atmospheres for longer time.

Solutions for HyL® Plants

Making full use of your potential

The performance of the materials intended for use in process gas heaters and DRI steam reformers is constantly improving. At the same time, the specifications for the processing and installation of these high-end materials in DRI plants are likewise becoming more and more challenging. In order to handle these requirements, we have now created a new business unit specifically dedicated to this purpose: S+C Installation Services.

The unit is fully focussed on handling the installation of radiant coils, heat exchanger bundles, reformer tubes, manifolds, T-pieces etc. in your production plant, combining cost efficiency with uncompromising attention to operational safety. We have the ability to implement these services with newly built projects, scheduled shutdowns or emergency troubleshooting. We are also an equally competent partner for inspections, operating data analysis, performance monitoring, etc.

Schmidt + Clemens launched into business as a parts supplier and has since evolved into a complete system provider. We are therefore naturally also able to offer you complete reformer tube assemblies and coils, all from an one-stop shop. But also in this case, our goal is, as always, to bring the performance and availability of your plant up to the highest possible level.

Our services at a glance

- Reformer tubes inspection
- Plant data collection evaluation
- Reformer tubes performance monitoring
- Technical assistance during major shutdowns
- Material selection consultancy
- Metallurgical and remaining life consultancy
- Site installation
- Assistance to emergencies

Our supply at a glance

- T-pieces
- Ceramic fibres and refractories
- Cones and flanges
- Top and bottom canister assemblies
- Backing rings
- Static casting fittings
- Welding consumables

Complete service & supply

Schmidt + Clemens Group

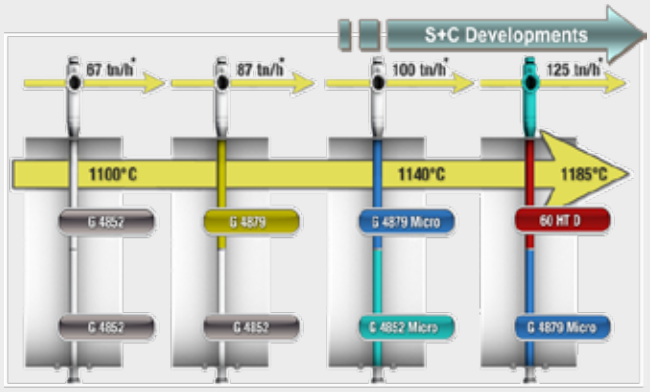
Innovation geared to practical application

Schmidt + Clemens holds the leading position in the DR market, being the unquestionable reference company regarding quality and reliability of their products. This strong market position is due to the great effort of the S+C group during the last years to understand their customer needs and develop products to meet the most demanding requirements.

For many years, S+C has been the pioneer of new developments in the DR Market such as the specifically developed micro alloyed materials for the DR Midrex® and HyL® markets, capable of achieving the longest time in operation with the highest dimensional stability.

One of the most demanding enterprises that the S+C group was engaged in, was the research and development of a new material suitable to allow higher operation of the Midrex® reformers and HyL® PGH, limited until then by the metallurgical constrain of the available materials. Using the group synergy, the knowledge achieved during the development of alloys for extreme high temperature applications and a multidisciplinary approach led S+C to introduce into the market the latest alloy generation, Centralloy® 60 HT D and Centralloy® HT E. Simplicity in the result of using aluminium as alloying element does not reflect the technical complexity in achieving the desired highest resistance to oxidation and creep. The superior properties of both alloys have set a new limit for the operation of DR plants.

Outstanding R&D



*** Theoretical Reformer Capacity for 288 (8" ID) – 220 (10" ID) tubes**

Such performance has not only been tested on laboratory scale. Upscaling from lab tests to pilot plant testing was first ever done in order to ensure a proper selection of this material for use at higher temperatures than ever.

Specially designed pilot plants allowed applying the most stringent testing conditions leading to even higher exposure temperatures than those targeted during full scale plant operation, in order to ensure reliability for the customer furnace. Continuous operation at a firebox temperature of 1200 °C was first reproduced.

The long term commitment and dedication of S+C with the R&D for DR includes dedicated technical and human resources ensuring customer satisfaction and products able to meet their highest expectancies.

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How can we support you?

Schmidt + Clemens meets and satisfies the growing challenges in the direct reduction industry. Work with us and experience how satisfying, cost effective, and reliable a cooperating partner can be. Let yourself be convinced by our technologically advanced product alternatives.

We are ready

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Schmidt + Clemens Group