Lifting technology, crane components — leading the way in explosion protection
STAHL CraneSystems
The Experts

At the forefront  Over 130 years of tradition, over 130 years of practical approach, competence and experience. STAHL CraneSystems can look back on a history characterised by the constant drive for innovation and significant developments. At the end of the nineteen-twenties, STAHL CraneSystems was one of the first, and for some time the only manufacturer to influence and advance the development of explosion-protected lifting technology. Revolutionary and pioneering in many fields, always receptive to new aspects, we have amassed a wealth of experience that gives us distinct advantages today. Profit from these advantages, from the know-how of one of the world’s leading manufacturers of explosion-protected components and systems for overhead transportation. Technically and economically, our products not only belong to the top flight internationally but lead the way in the field of explosion protection.

1876  Company founded by Rafel Stahl
1898  First large electric portal crane
1922  First electric hoist with wire rope and drum
1926  Development of explosion-protected hoists, crane components and control technology begins
1935  Construction of explosion-protected crane systems up to a lifting capacity of 100,000 kg for the chemical industry
1953  World innovation: first explosion-protected flameproof enclosed electric wire rope hoist
1978  AS range of wire rope hoists
1983  T range of chain hoists
1997  ST range of chain hoists
1998  SH range of wire rope hoists
2003  STAHL CraneSystems implements the ATEX product directive 94/9/EC comprehensively for the whole range of products
2009  STAHL CraneSystems presents the world’s largest portfolio of explosion-protected lifting technology, drive technology and control technology
04 _ Explosion protection
06 _ Legal principles
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22 _ Service and training
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The beginnings of explosion protection are to be found in the mining industry where miners are exposed to the dangers of fire damp. This term refers to methane gas which escapes in coal mines in particular and which reacts explosively when combined with fine coal dust and air (fire damp explosion).

Explosive atmospheres may however occur in other branches of industry too, for example in the chemical or petrochemical industries. Electrical apparatus used in potentially explosive atmospheres must be constructed in such a way that it does not become a source of ignition. In order to avoid serious injuries and damage to material and the environment, safety regulations, laws, decrees and standards have been established in most states. Across the world, a high degree of safety has developed in explosion protection thanks to the standardisation of explosion protection regulations. This brochure merely outlines the European explosion protection directives. It cannot take the place of an intensive analysis of national legal principles and standards.

STAHL CraneSystems is pioneering, dynamic and uncompromising when the safety of persons and machines in areas subject to explosion hazards is at stake. STAHL CraneSystems occupies an exceptional position in this field with our many decades of experience and know-how, our own fundamental research and development, approvals from the Physikalisch-Technische Bundesanstalt (PTB) and other test institutes in many countries. All hoists and components without exception come from our own production, from motor and brake to controls and control pendant. STAHL CraneSystems is the world specialist for explosion protection and as world market leader offers the most comprehensive, complete programme of explosion-protected lifting, drive and control technology.
With the ATEX product directive 94/9/CE (ATEX 95) and the ATEX user directive 1999/92/EC (ATEX 137) the European Community has established the basis for uniform European explosion protection. This safety concept is applicable both for manufacturing electrical and non-electrical apparatus and for operating this apparatus in the respective industrial plants. The legislators of the individual member countries implement these directives in equivalent statutory regulations.

In Germany for example these are the Explosion Protection Ordinance ExVO (implementation of directive 94/9/EC), the Industrial Safety Ordinance (implementation of directive 1999/92/EC) and the Technical Regulations for Industrial Safety (TRBS), the regulations issued by the Employers’ Liability Insurance Associations (e.g. BGR 104, BGR 109 and BGR 132), the Employers’ Liability Insurance Association information sheets (e.g. BGI 740) and the regulations issued by the VDI (Association of German Engineers) (e.g. 2263 and 3673). ATEX directive 94/9/EC defines the properties required by apparatus for safe use in explosive areas. This includes classification into equipment groups and categories, the
respective conformity assessment procedures to be followed, manufacturers’ responsibility including CE conformity marking, basic safety requirements for the development and manufacture of explosion-protected equipment and recognised quality management measures to be implemented during production. ATEX directive 99/92/EC defines the obligations of users and employers for employees’ protection in explosive areas. Inter alia, the user must assess risk and classify the potentially explosive areas into corresponding zones so that the apparatus required by directive 94/9/EC can be used in safety.

Assessment of conformity in compliance with ATEX 95

<table>
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<tr>
<th>Category 1 and M1</th>
<th>EC prototype test (III)</th>
<th>Production quality assurance (IV)</th>
<th>Product verification (V)</th>
<th>Individual verification (XI)</th>
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<td>Quality assurance of products (VII)</td>
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<td>Other apparatus</td>
<td>In-house production testing (VIII) and documentation at notified body</td>
<td>Individual verification (XI)</td>
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Assessment of conformity in compliance with ATEX 95. The figures in brackets refer to the modules of directive 94/9/EC which define the procedures to be followed for meeting conformity.

Useful links

**ATEX**
http://ec.europa.eu/enterprise/atex

**Explosion Protection Ordinance (11th GPSGV)**
http://bundesrecht.juris.de/gsgv_11

**Technical Regulations for Industrial Safety (TRBS)**
http://www.baua.de/

**Industrial Safety Ordinance (BetrSichV)**
http://bundesrecht.juris.de/betrsichv

**Regulations and information sheets of Employers’ Liability Insurance Associations**
http://www.bg-metall.de/

**VDI regulations**
http://www.vdi.de
An explosion is a precipitate chemical reaction of combustible matter with oxygen setting free high energy. In this connection, combustible matter may be gases, mists, vapours or dusts. An explosion can only take place if three factors come together: combustible matter (in suitable dispersion and concentration), oxygen (in the air) and a source of ignition (e.g. an electric spark).

It is thus necessary to prevent ignition or reduce the effect of an explosion to an innocuous level. To ensure this, apparatus which is used in potentially explosive atmospheres must be designed, manufactured and of course marked in compliance with the provisions of ATEX product directive 94/9/EC. Classification of devices into groups and categories results from their area of use or the safety level of protective measures and the frequency of occurrence of an explosive atmosphere. The highest possible risk potential must be taken into account when carrying out this classification. Only explosion-protected apparatus may be used in areas in which explosive atmospheres may occur in spite of all preventive measures. This apparatus is produced in various types of protection in accordance with the corresponding construction regulations (series of standards EN 60079, EN 61241 and EN 13463).

**Physical and technical principles**

**Ex d** Flameproof enclosure

**Ex p** Pressurised apparatus

**Ex e** Increased safety

**Ex n** Zone 2 equipment

**Ex o** Oil immersion

**Ex m** Encapsulation

**Ex np** Optical radiation

**Ex i** Intrinsic safety

**Ex q** Powder filling

EN 60079 for equipment in areas subject to gas explosion hazards
The type of protection used by the manufacturer depends on the type and function of the device. All standardised types of protection within a category are equivalent. In the CE declaration of conformity included in the technical documentation the manufacturer confirms that the product meets the ATEX directives.

**En 13463** for non-electrical equipment in areas subject to gas/dust explosions

- Ex b Monitoring sources of ignition (EN 13463-6)
- Ex c Constructio-nal safety (EN 13463-5)
- Ex fr Restricted breathing apparatus (EN 13463-2)
- Ex h Liquid immersion (EN 13463-8)
- Ex d Flameproof enclosure (EN 13463-3)
- Ex p Pressurised apparatus (EN 13463-7)

**En 61241** for equipment in areas subject to dust explosions

- Ex d Protection by housing (EN 61241-1)
- Ex fD Intrinsic safety (EN 61241-11)
- Ex pD Pressurised apparatus (EN 61241-4)
- Ex miD Encapsu-lation (EN 61241-18)
ATEX directive 1999/92/EC defines users’ obligations for the protection of employees working in potentially explosive atmospheres. The user is obliged to establish technical and organisational measures to prevent explosions occurring. In this respect he must for example assess the potential danger and explosion risk, ensure that the working environment has been designed for safety and classify the hazardous areas into zones in accordance with the directives for safe operation of the apparatus which has been classified into categories. In addition he is obliged to issue and maintain an explosion protection document.

Naturally further issues are defined in directive 1999/92/EC in order to implement explosion protection effectively. After a system has been commissioned in due form it must be monitored and maintained so that the safe condition of the system is ensured and all dangers can be excluded.

The plant’s expert has product-specific documents (rating plate, operating instructions, EC prototype test certificate, declaration of conformity, etc.) and universally valid documents (legal ordinances, industrial safety ordinance, technical regulations, norms and standards, etc.) at his disposal. The full product-specific documentation must be managed and retained throughout the period of use of the apparatus and placed at the disposal of the experts entrusted with maintenance work.
Primary explosion protection
Preventing the formation of hazardous explosive atmospheres

Secondary explosion protection
Preventing the ignition of hazardous explosive atmospheres

Tertiary explosion protection
Restricting the effects of an explosion to an innocuous level

New equipment
Modification of equipment, working material, the work environment or the personnel using the equipment

Risk diagram
Integrated explosion protection

Ascertain risks
Assess risks

Are safety and health protection of the employees ensured without additional measures being taken?

Define actions (e.g. tests)
Implement actions
Check effectiveness of actions

Are the actions sufficiently effective and are no new risks likely to occur?

Document results
As the world’s leading manufacturer of explosion-protected lifting technology and explosion-protected crane components, STAHL CraneSystems offers the widest complete portfolio and comprehensive services in this field. Explosion-protected products from STAHL CraneSystems meet not only national German laws and European ATEX directives but also international standards and laws for the American and Asian market.

Our prototypes are certified after passing an EC prototype test and undergo the conformity assessment procedure specified in the directives. Development and manufacture of the series products are subject to our strict quality management monitored by independent European inspection authorities. The test certificates from the notified European inspection authorities are recognised throughout the EU. The rating plates indicate in addition to the usual data (manufacturer, type, serial number, electrical data) the data relevant to explosion protection.

CE marking of the products, declaration of conformity in writing and detailed operating instructions and documentation confirm that all valid EC directives applicable to the apparatus are observed. Decades of experience in the field of explosion protection, responsible, competent staff and production in accordance with the latest directives and standards guarantee quality down to the last detail for every piece of explosion-protected equipment from STAHL CraneSystems.
ZERTIFIKAT

Die TÜV CERT-Zertifizierungsstelle

der TÜV Management Service GmbH

bescheinigt gemäß

TÜV CERT-Verfahren, dass das Unternehmen

STAHL CraneSystems GmbH

Daimlerstr. 6

D-74653 Künzelsau

einschließlich den Standorten gemäß Anlage

für den Geltungsbereich

Entwicklung, Produktion und Vertrieb von

Kettenzügen, Seilzügen, Kranen, Kleinkransystemen und

individuellen Systemlösungen, Krankomponenten, Kransteuerungen,

Steuergeräten, elektronische Wegeerfassungs- und Datenübertragunssystemen,

Originalteilen, Instandhaltungs-, Instandsetzungs- und

Serviceleistungen, fördertechnischem Zubehör

ein Qualitätsmanagementsystem

eingeführt hat und anwendet.

Durch ein Audit, Bericht-Nr.

70025219

wurde der Nachweis erbracht, dass die Forderungen der

ISO 9001: 2000

erfüllt sind. Dieses Zertifikat ist gültig bis

2006-11-30

Zertifikat-Registrier-Nr.

12 100 20484

München, 2006-02-09

TGA-ZM-18-96

TÜV CERT-Zertifizierungsstelle

der TÜV SÜD Management Service GmbH

Specific marking of explosion-protected devices

CEN/CENELEC/IEC

Symbol for explosion protection

for electrical apparatus only)

Types of protection:

Ignition source monitoring – b

Constructional safety – c | Flameproof enclosure – d, db

Increased safety – eb | Restricted breathing enclosure – fe

Intrinsic safety – ia, ib, ie | Liquid immersion – k

Encapsulation – na, nb | Type of protection in – nAr, nC, nR

Oil immersion – ob | Pressurised enclosure – p, pxb, pyb, pyc

Powder filling – qb | Protection by housing – ta, tb, tc

Gas group:

e.g. propane – IIA

e.g. ethylene – IIB

e.g. hydrogen – IIC

Dust group:

combustible flakes – II A

non-conductive dust – II B

conductive dust – II C

Gas group:

e.g. propane – IIA

e.g. ethylene – IIB

e.g. hydrogen – IIC

Dust group:

combustible flakes – II A

non-conductive dust – II B

conductive dust – II C

Gas: temperature classes – max. surface temperature

T1 – 450 °C  T2 – 300 °C  T3 – 200 °C  T5 – 100 °C

T4 – 135 °C  T5 – 85 °C

Dust: specification of max. surface temperature in °C (as required)

Gb

(Example of device marking)

ATEX (EU directive 94/9/EC)

CE marking

Symbol for explosion protection

Equipment group: mining – I

Other potentially explosive atmospheres – II

Equipment category

very high safety level – 1

high safety level – 2

normal safety level – 3

*for Equipment Group I: M1, M2

Type of explosive atmosphere for Group II

Gases, vapours, mists

Zone 0, 1, 2

Dust

Zone 20, 21, 22
Danger points

In focus  In lifting, drive and control technology both electrical and non-electrical components and parts can trigger an explosion. STAHL CraneSystems therefore offers apparatus specially designed for use in potentially explosive atmospheres. All hoists and crane components without exception are from our own production, from motor and brake to controls and switchgear, and meet the latest European construction and safety regulations for potentially explosive atmospheres (ATEX).

1 Wheels
The type of protection of all wheels is constructional safety »c«. If travel speeds are high, this also includes brass wheels.

2 Gear
The types of protection of the gear are constructional safety »c« and liquid immersion »k«. The protective liquid (oil) prevents sparks.

3 Rope guide/ chain guide
The wear-resistant rope guide in nodular graphite casting GJS (previously designated GGG) is extremely durable and not subject to temperature limitations. The same applies to the chain guide, type of protection used: constructional safety »c«.

4 Equipotential bonding
Equipotential bonding is essential for avoiding incendive sparks when installing crane technology in potentially explosive atmospheres.

5 Overload device
The overload devices for Zone 1 and 21 comprise mechanical sensors (LMS), analog sensors (LET) for Zone 2 and 22.

6 Panel box
The type of protection for panel boxes for Zone 1, 2 and 21 on cranes and hoists combines types of protection flameproof enclosure »d«, increased safety »e« and protection by housing »tD«.


11 Motors

Motors for Zone 1 and 21 are made of grey cast iron, the type of protection combines flameproof enclosure »d«, increased safety »e« and protection by housing »tD«. For Zone 2 the motors are made of aluminium and in type of protection non-sparking equipment »nA«. For Zone 22 the motors are manufactured in IP 66.

10 Cable entry

Indirect cable entry, very high safety level from type of protection increased safety »e« and flameproof enclosure »d«. Connection of the Ex e connection box to Ex d by post-type bushing.

7 Control pendant

The type of protection of the housing is IP66, installed elements protected by flameproof enclosure »d«, increased safety »e« and protection by housing »tD«.

8 Limit switch

The type of protection of the limit switch combines flameproof enclosure »d«, increased safety »e« and protection by housing »tD«.

9 Bottom hook block

The type of protection employed is constructional safety »c«, no aluminium is used. If travel speeds are high, individual parts, such as the load hook, are bronze-coated.
SHex wire rope hoists are available for Zone 1 and Zone 2, and for Zone 21 and Zone 22. They reliably meet the technical, normative and practical requirements specified by ATEX.

Chemical plant ... A single girder overhead travelling crane with a lifting capacity of 5,000 kg is operated by radio remote control in this hazardous area. It transports goods over several storeys through a shaft.

Double girder overhead travelling cranes with explosion-protected wire rope hoists in twin design with auxiliary hoist provide assistance during the maintenance of compressors in a hydrogen liquefaction plant.

<table>
<thead>
<tr>
<th>Use</th>
<th>Category</th>
<th>Protection against</th>
<th>Explosion protection class</th>
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<tbody>
<tr>
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<td>II 2 G</td>
<td>Gas</td>
<td>Ex de IIB T4 or Ex de IIC T4</td>
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<tr>
<td>Zone 2</td>
<td>II 3 G</td>
<td>Gas</td>
<td>Ex de nA IIB T3 (T4) or Ex de nA IIC T3 (T4)</td>
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<td>Zone 21</td>
<td>II 2 D</td>
<td>Dust</td>
<td>Ex d I A21 IP66 T 120 °C</td>
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<tr>
<td>Zone 22</td>
<td>II 3 D</td>
<td>Dust</td>
<td>Ex d I A22 IP66 T 120 °C</td>
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</table>
Explosion-protected wire rope hoists

**Powerful**  
The SHex and ASex explosion-protected wire rope hoists from STAHL CraneSystems meet EC product directive 94/9/EC (ATEX 95). They are constructed for use in Zone 1 or Zone 21, however they can also be used in Zone 2 or Zone 22. These adaptable wire rope hoists are of systematically modular construction and designed for a load capacity range of 1,000 kg to 160,000 kg. For the load capacity range of 1,000 kg to 25,000 kg the versatile SHex series is available in five frame sizes with 15 load capacity brackets.

The upper load capacity range up to 100,000 kg is covered by the field-proven ASex series. The SHWex winch programme extends the range of applications in the high-load bracket up to 160,000 kg. The attractive design of STAHL CraneSystems’ wire rope hoists conceals a compact, robust construction which is largely low-maintenance. They are extremely reliable and have a longer-than-average service life. Common to all of them is the particularly smooth precise starting and braking characteristic.

- **Progressive**  _condition monitoring apparatus in explosion-protected design ensures safe operation. Electronic motor and brake management guarantees a long service life.
- **High-profile**  _most comprehensive explosion-protected wire rope hoist programme for the load capacity range from 500 kg to 160,000 kg.
- **High-powered**  _equipped as standard with two hoisting and two travelling speeds
- **Long-lived**  _particularly high standard classification in accordance with FEM

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*only Zone 2, 22
**only Zone 1, 21

1Am 2m 1Am

2m 2m 1Am

1Bm* 3m 2m 1Am

1Bm* 3m 2m 1Am

1Bm*
Chemical plant... Here a single girder suspension crane with 1,600 kg load capacity is used for transporting system parts during maintenance work outdoors. The compact trolley of the explosion-protected chain hoist permits the full width of the crane bridge to be utilised.

The ST chain hoist in explosion-protected design is available in two frame sizes up to a load capacity of 6,300 kg.

<table>
<thead>
<tr>
<th>Use</th>
<th>Category</th>
<th>Protection against</th>
<th>Explosion protection class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>II 2 G</td>
<td>Gas</td>
<td>Ex de IIB T4 or Ex de IIC T4</td>
</tr>
<tr>
<td>Zone 21</td>
<td>II 2 D</td>
<td>Dust</td>
<td>Ex d A21 IP66 T120 °C</td>
</tr>
<tr>
<td>Zone 22</td>
<td>II 3 D</td>
<td>Dust</td>
<td>Ex d A22 IP66 T120 °C</td>
</tr>
</tbody>
</table>
The STex explosion-protected chain hoists from STAHL CraneSystems meet EC product directive 94/9/EC (ATEX 95). They are constructed for use in Zone 1 or Zone 21, however they can also be used in Zone 22. This series of chain hoists belongs to the most distinctive and comprehensive on offer in the world. In use in thousands of applications for decades, modernised and optimised again and again, this chain hoist is a classic, powerful, reliable and demanding as regards maintenance and power consumption. The STex series is available in 13 load capacity brackets from 125 kg to 6,300 kg. It can be used as stationary hoist with suspension hook or eye, rigid suspension, or with push or electric trolley, and is particularly suitable for rugged use in industry. The innovative and pioneering design of the chain hoist brings considerable economic advantages. The extremely short headroom available as an option for every type of chain hoist optimises the effective hook height while minimising wear on the chain. In addition to standard versions, further off-standard versions and customer-specific solutions are available.

### Explosion-protected chain hoists

<table>
<thead>
<tr>
<th>Type</th>
<th>Reeving</th>
<th>Load capacity for Zone 1 and 21 [kg]</th>
<th>Load capacity for Zone 22 [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST05</td>
<td>1/1</td>
<td>250</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>2/1</td>
<td>3/2m</td>
<td>1Am</td>
</tr>
<tr>
<td>ST10</td>
<td>1/1</td>
<td>1/Am</td>
<td>1Am</td>
</tr>
<tr>
<td></td>
<td>2/1</td>
<td></td>
<td>1Am</td>
</tr>
<tr>
<td>ST20</td>
<td>1/1</td>
<td>3m</td>
<td>3m</td>
</tr>
<tr>
<td></td>
<td>2/1</td>
<td></td>
<td>3m</td>
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<td>ST30</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>2/1</td>
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</tr>
<tr>
<td>ST50</td>
<td>1/1</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>2/1</td>
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<tr>
<td>ST60</td>
<td>1/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2/1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The SWH 5ex control pendants are specially designed for controlling hoists and cranes in hazardous areas. Operation is 2-step and permits rapid changeover from «fast» to «slow» and back. All control pendants have an emergency stop slam button which meets the requirements of EN 60947-5-5.

Flameproof enclosure for Zone 1 and Zone 2 ... The sheet steel or aluminium housings can be used as single housings or for housing combinations. All necessary components such as transformers, contactors, fuses, measuring instruments and tripping devices can be installed in the modular housings. Connection to the connection box (increased safety Ex e) is made by post-type bushings.

If travel speeds are elevated or very high, the load hook and the solid parts are bronze-coated on surfaces which might strike against obstacles. All other external surfaces of the bottom hook block can be bronze-coated if desired to prevent sparking.

Modern crane systems up to a load capacity of 50,000 kg and a span of 30 m can be built using explosion-protected suspension and overhead travelling crane endcarriages. For particular applications, at the customer’s request and to improve safety, all wheels can be supplied in brass.
Explosion-protected components and electrics

Modular  The components and electrics, which also meet EC product directive 94/9/EC (ATEX 95), are the perfect complement to explosion-protected lifting technology from STAHL CraneSystems. The correct functioning and high performance of a crane system depends on the quality of all its components. These are developed down to the last detail by STAHL CraneSystems and supplied from our own production. Forward-looking, high-quality modules complement one another in the system and ensure both safety and cost-effectiveness. Using the modular components, our crane manufacturing partners in your area are able to adapt the crane system individually to customer-specific requirements and wishes. Mature cost-effective electronics, drive technology to meet the highest demands, innovative modules and field-proven, robust standard components are available for these adaptations. The competent crane manufacturing partners and experienced system manufacturers are trained by STAHL CraneSystems’ explosion protection experts so that they are always up to date as regards the status of ATEX directives and state-of-the-art technology.

### Explosion-protected crane endcarriages
- For single-girder overhead travelling cranes, 7 wheel diameters and 5 wheelbases
- For double-girder overhead travelling cranes, 7 wheel diameters and 6 wheelbases
- For single-girder suspension cranes, 4 wheel diameters and 3 wheelbases

### Explosion-protected drive technology
- Supplied as standard with 2-step speeds 20/5 m/min or 40/10 m/min, other speeds on request
- As an option, stepless speed control

### Explosion-protected control technology
- SWH5ex wired control pendant
- Panel box in explosion-protected design

### Explosion-protected electrics
- Festoon cables in conjunction with control pendants or radio remote controls
Service and training

Perfect  STAHL CraneSystems is committed exclusively to capable, professional crane manufacturing partners and systems manufacturers. You can expect maximum support from them when your individual crane system with components from STAHL CraneSystems is at stake. This support does not end with consulting on and erecting a new system, but continues to apply afterwards in system-oriented inspection and maintenance, spare parts supply and much more, and includes training courses. In this respect, STAHL CraneSystems offers a perfectly coordinated service. We always keep our regional crane manufacturing partners up to date with training courses, seminars and information material. You too can profit directly from our know-how. We impart practical and theoretical knowledge in our own training centre or on your premises. The seminars on offer in the form of individual, basic and advanced courses cover all main product groups. However we would also be pleased to match a special programme to your individual specifications and requirements. So why not invest in the qualification of your staff and take advantage of our seminar programme.
In action world-wide

Consummate  You will find explosion-protected lifting technology, drive technology and control technology from STAHL CraneSystems all around the world. Planned and developed by the explosion protection experts, manufactured with the greatest care down to the last detail in our own factory in Germany. All over the world, many companies from various branches of industry have decided on the highest degree of safety and quality, on products from STAHL CraneSystems. We would like to list just a few of them here:

Europe
ABB Lummus Global GmbH, Germany
ABB Lummus Global GmbH, Spain
AkerKvaerner (Houston, USA), Italy
Borealis, Germany
BP CHEMBEL N.V., Belgium
Cobra Plantas Industriales, Spain
Eastern Petrochemical Co (Linde), Germany
Fluor, Germany
Fluor Daniel B.V., Norway
Fluxys Refinery, Belgium
Intecsa Industrial, Spain
Jacobs Engineering, Germany
Motor Oil Refineries Corinth, Greece
OMV Burghausen, Germany
Repsol Petroleos S.A. Petronor, Spain
Repsol YPF/Petronor, Spain
Sagás, Spain
Saipem S.A. (Technigas), Belgium
Scanraff Refinery (PREFEM), Sweden
Sparrows Offshore Services Ltd, Great Britain
Statol, Norway
Technip, Belgium
Ticosa, Germany
Total Refinery (Antwerp), Belgium
Turkey Petrof Rahmerileri A.S., Turkey
voestalpine AG (Linz), Austria

Asia
Aila Co., Thailand
Daelim Engineering Co., Iran
Ethylene Malaysia Sdn. Bhd., Malaysia
Formosa Plastics Corporation, Taiwan
Foster Wheeler, Malaysia
GS Engineering and Construction Corp., Thailand
Hercules Chemical (Nanjing) Co., Ltd, China
Iran Chemical Industries Investment Co., Iran
Jacobs Engineering, Singapore
JIO Corporation (Japan), Oman
Kuwait National Petroleum Co., Kuwait
MAN Ferrostaal Essen, Oman
MaisonWorleyParsons (Shanghai), China
Mitsubishi Heavy Industries, Brunei
PT Wirya Krendo Perkasa, Indonesia
Qatar Petroleum Dolphin Energy Co., U.A.E.
Ras Laffan Olefins Company Limited (RLOC), Qatar
Samsung, Saudi Arabia
Saudi Petrochemical Company, Saudi Arabia
SemCorp Simon Carves (Great Britain), China
Singapore Refining Co., Ltd, Singapore
Sparrows Offshore Services Ltd., Azerbaijan
Technip France (Paris), Qatar
The Kuwait Olefins Company (TKOC), Kuwait
Toyo-Thai (Bayer BPA), Thailand

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UTE RKF Argelia, Algeria

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UTE Coker Aconcagua, Chile

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