An important chance for optimising the productivity in rolling mills consists of combining single processes in an efficient and reliable manner. Referring to that approach, the 2 photos on this page show a 15 t crane spreader beam before and after the weighing modernisation. This crane is used to transport finished or collected wire rod bar bundles to the sales stockyard.

Installing a SCHENCK scale inside the spreader beam has allowed execution of the 2 process steps “Transport” and “Legal for Trade Weighing” more or less simultaneously. The former additional step “Positioning of the bundle onto a separate platform scale” has been eliminated.

The saving in time directly leads to an increase of productivity of the “Crane Transport” that often represents a bottleneck in the Rolling Mill production.

Realising the principle: Time is money
Modernisation of Weighing in rolling mills
The photo to the right side explains the working principle of the tailor-made crane scale: by completely separating the sheave block from the spreader beam body we integrated a direct and entire load transmission over 2 x 2 Loadcells RTN 10 t with Elastomer Mounts VEN 10. The arrangement of the Loadcells at the sides of the beam generated the following design and operation advantages:
- The working height of the spreader beam remained unaltered;
- Mechanically, the Loadcells were well protected;
- The bumpers and hold-downs were well accessible, controllable and adjustable.

The next 2 photos show a very similar integration of a weighing system in the transportation process:

It concerns a raising platform car working at the logistical interface between the crane transport of coil bundles from the annealing furnace and the forklift transport to the dispatching area. Also, at this location the costumer formerly used a separate platform scale for Legal-for-Trade weighing. The new coil bundle scale has a weighing range of 5 t. It was designed with 4 x RTN 4,7 C3 Loadcells, 4 x VEN 4,7 Elastomer Mounts and reinforced horizontal bumpers and hold-downs for the safe transmission of the dynamic loads during charging.

These examples show, that in the Rolling Mill usually “Legal for Trade” scales are required. This is an important difference from the other areas of steel plant, where especially “process or internal weighing systems” are installed. This application difference is due to the fact, that the weighing results in the Rolling Mill are used for invoicing, for example in contracts with external steel trade companies. Those scales used for commercial invoicing must follow the national legalisation rules.

That implies for example the following conditions:
- The weighing components installed inside must have an official type test, for example certified by the PTB in Braunschweig.
- The scale must achieve clearly defined operational specific weighing tolerances (during initial verification and operation).

Please find the **tolerances for the initial verification** for the raising platform scale illustrated on this page with a Weighing Range of 5 t and an increment value of 2 kg (representing a legal for trade resolution of 2,500 digits):

<table>
<thead>
<tr>
<th>Test load</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 kg ... 1t</td>
<td>± 1 kg</td>
</tr>
<tr>
<td>1 t ... 4t</td>
<td>± 2 kg</td>
</tr>
<tr>
<td>4 t ... 5t</td>
<td>± 3 kg</td>
</tr>
</tbody>
</table>

After the successful initial verification, the scales have to respect in operation the so-called **in-service accuracy tolerances** until the next verification date. They allow the double weighing error in relation to the initial verification. SCHENCK uses Rolling Mills Loadcells RTN with a Rated Capacity between 1 - 47 t and accuracy classes up to 5,000 digits in combination with the Weighing Terminal Disomat Bplus for these Legal-for-Trade scales.
When in summer 1985 at Hoogovens in the Netherlands for the first time SCHENCK - Weighbeams had been commissioned successfully inside a ladle turret, it was quickly proven, that indeed an innovative new technology for various weighing applications in the heavy industries had been created.

At the occasion of this jubilee the today’s edition of the HI - News points out the essential features and advantages of SCHENCK - Direct Weighing, always looking for new beneficial applications in your working processes.

As a first example we would like to present to You two different executions of a special bin weighing system:

**Execution 1:**
Support of the bin on 3 Loadcells with elastomer mounts, horizontal tie-rods and pre-strengthened hold-downs:

For standard bin weighers the conventional solution - using Loadcells RTN and Compact Mounts VKN - still remains the most economical solution in future. Nevertheless for systems with special installation conditions, like the here discussed supporting point of the top-hopper silo of a blast furnace, such as

- high wind and seismic loads, or
- lifting forces caused by internal process pressure

execution 2 shows a mechanically completely different solution, now using the SCHENCK - Direct Weighing Technologies:

**Execution 2:**
Support of the bin on 3 Weighbeams DWB.

The simple comparison of the two photos reveals the crucial features and the advantages of Direct Weighing in this application:
At each of the three supporting points one Weighbeam DWB is simply screwed
from the bin suspension ring and to the steel foundation.

The major difference to execution 1 is based on the principle, that absolutely no further supporting elements between the bin and the ground are required anymore, leading straight to the following advantages:

- no shunt forces, that especially on the long term operation are difficult to manage,
- no moving parts,
- no mechanical adjustment works,
- for the mechanical installation no special training is needed,
- the weighing system based on Weighbeams works entirely maintenance-free and insensitive against dirt or dust pollution.

Obviously many internal process weighing systems can be executed in an easier and finally more reliable manner using SCHENCK -Direct Weighing Technologies. Problems with blocked tie-rods, hold-downs or closed bumper gaps will disappear for all times!

As second example for an economical and successful installation of SCHENCK-Direct Weighing please find below two photos of three new built scrap trailers with a total gross weight of 120 t each. The weighing system installed simply consists of 4 Weighbeams DWB 50t in a double frame arrangement. Different from the conventional solution for such a weighing double frame (using Loadcells RTN, Elastomer mounts VEN, external bumpers and hold-downs), also in this case the Weighbeams have been simply screwed between the upper weighing frame and the trailer wheel base frame. In the heavy and dirty surrounding of the scrap yard this solution contains several advantages:

For the manufacturer of the trailer:
- easy design using standardised sensors,
- easy and quick commissioning due to the minimised number of parts.

For the final costumer in the steel plant:
- highly minimised shunt forces by dirt and dust,
- high accuracy with a deviation during scrap loading of less than ± 300 kg,
- high mechanical stability of the dynamic load transmission during scrap loading.

Schenck - Direct Weighing Technologies:
The simple solution without compromise!
Check Weighers for burden and alloy hoppers:
Process control at the highest level

For burdening and alloying every steel plant works with a big number of hopper weighing systems for sinter, coke, additives and the various alloying elements. These hopper scales are especially used for the material composition, which means they are responsible for the security and the quality of the chemical processes inside the Blast Furnace, the Converter and the EAF, finally leading to the required quality of pig iron and finished steel. That short description already explains, why this kind of hopper scales must work especially precise and reliable at every moment of time.

Although the high quality of the modern Loadcells principally guarantees these performances, nevertheless functional disturbances of the weighing systems after long years of operation in the harsh environmental conditions (for example caused by cable damages or raising shunt forces) cannot be completely excluded. Therefore we feel growing interest of our customers to verify the proper performance of these especially important hopper scales with minimum effort of manpower, time and material: for that task we recommend Schenck Check Weighers for hoppers in a mobile or fixed installation according to the principle arrangement represented on the figure below:
The here presented Check Weigher consists of

- a force directing steel frame,
- one reference Loadcell and
- one hydraulic cylinder.

The upper connection of that compact unit is fixed onto a central point of the tested hopper. The lower connection is fixed to the ground by the combination of a fixed pin and a slotted hole inside the frame. During normal production the zero - position of the cylinder and the slotted hole guarantee, that the Check Weigher cannot transmit any vertical force.

At the moment of checking, the hydraulic cylinder lifts the lower flange of the frame against the fixed pin (by hand pump or coupled system pressure). From that moment further pressure generates a control force transmitted identically

- over the Loadcells of the hopper scale, and as counter-reaction
- over the reference Loadcell of the Check Weigher.

The verification of the scale is executed by the comparison of the display changes of the two weighing electronics, that are caused by this control force.

From the weighing point of view that procedure represents a **linearity check** of the sensitivity, that may reveal the following functional problems:

- Load depending shunt forces, caused for example by compressed dust or additional mechanical installations between the weighing and the non - weighing sections;
- partly improper function of Loadcells and Mounts.

Under normal performances of the hopper scale that check very quickly and clearly confirms the expected high accuracy of the entire measuring chain with a linearity deviation of maximum ± 0,1 % of the applied control force impressively.

Additionally the Schenck DiSONBOX offers the possibility to **check the zero-point** of every single Loadcell automatically after every total evacuation of the hopper.

This combination of a regularly **check of zero-point** and **linearity check** for the most important hopper scales contributes at a high extent to the optimisation of both process safety and availability.

Compared to the conventional time and effort consuming check methods with standard masses (see photo at the right side) this kind of preventive maintenance with Schenck Check Weighers represents a reasonable and economical investment in various respects.
schenckservices for Weighing and Dosing systems:
much more than installation and commissioning

In the harsh environment of the various weighing and dosing systems operating in steel industry excellent product properties and a close cooperation between Schenck Process and its worldwide partners in all service matters are essential in order to guarantee a maximum of accuracy and reliability.

Considering the high pressure on efficiency in steel production with constantly growing targets Schenck Process has started a special program to strengthen cooperation with the weighing specialists in the steel plants, following the objectives listed above:

- higher availability and reliability by using modern features for preventive maintenance
- quicker information exchange and industrial realisation of innovation and field-experiences in mechanics, electronics, fieldbus technologies and maintenance
- intensivation of the contact in terms of quality assurance according to DIN ISO

On the next page we like to present some of our service product ideas, at the same time kindly asking from You a short feedback by Fax or Mail return:
1. Are You able to analyse every Loadcell?
If You are responsible for extremely process sensitive weighing systems in 24 hour operation, we recommend to reduce the consequences of eventual damages by preventive maintenance in time! Installing the DISOBOX instead of the conventional junction boxes enables the maintenance staff to check in the control room every single Loadcell additionally to the total weight display. More detailed information allows to activate an emergency mode by simple electronic adjustment assuring the scale operation. For Your training our completely pre-assembled DISOBOX-Base-Package is available at stock.

2. Do You know the precise weight of Your calibration ladles?
Specialists know, that this is a difficult question, although the calibration ladles used for the electronic adjustment of all crane, ladle car and turret scales play an important role for precise mass balancing of the steel production. We are planning to weigh Your calibration ladles at site using a special Control Measurement Device. Afterwards You will be able to answer the above question convincingly …

3. Teamwork makes us stronger!
Sophisticated downloads, modernisation of old electronics, regular information about new products, certified training for new colleagues, held in-plant or at a close Schenck Location as well as personalised telephone support: with our new service package we want to recommend ourselves - even more than in the past - as first partner of the weighing and dosing specialist in the steel plants!

4. Always in trouble because of weighing mechanics?
Have You been bothered for long time by older weighing systems not properly working anymore for any mechanical reasons? We offer to investigate these scales at site, followed by an engineering report containing modification proposals, based on our experience with steel plant weighing systems world wide. Could we attract Your interest? Or do You have further areas in mind, where further Schenck service assistance would be appreciated?

Please give us a short feedback to these questions:
Service products: Interesting? yes / no
1. Are You able to analyse every Loadcell? □ / □
2. Do You know the precise weight of Your calibration ladles? □ / □
3. Teamwork makes us stronger! □ / □
4. Always in trouble for weighing mechanics? □ / □
Your comments and additional suggestions:

Your name: __________________________ Country: __________________________
Your company: __________________________ City: __________________________
Mail address: __________________________

Please re-send that page after completion to: Fax: +49 (0)6151 32-3270 or m.brauer@schenckprocess.com
Thank You very much for Your assistance, our Service department will contact You!
A new member of the DISOMAT® family:

the DISOMAT® Opus

The latest edition of the DISOMAT® family demonstrates, that legal-for-trade logistic solutions today can be realised very cost-effectively. The development of this new product was carried out based of the proven DISOMAT® B plus Weighing Terminal.

Thanks to the comprehensive communication facilities our new device can be easily integrated into data-processing and control systems such as MPC, PC or others. Whether conventional I/O, industrial fieldbus or USB interfaces are required: the DISOMAT® Opus is at home in every environment and even includes an integral on-board Ethernet port.

The heart of the DISOMAT® Opus is the new 32 Bit ARM controller, which offers more than enough performance reserves for quick weighing processes and the simultaneous operation of several interfaces.

The DISOMAT® Opus is perfectly suited for all applications, in which weight values must be recorded in legal-for-trade operation, displayed, printed out and transmitted to higher level automation systems for further processing. It can cover a wide range of different process applications, such as:

- platform scales
- hopper scales
- level monitoring systems
- truck scales
- crane scales
- single component dosing systems

For user-friendly adjustment the DISOPLAN® graphic user interface enables quick and easy adaptation of the operation and print format, calibration, back-up and restore functions.

These are perfect conditions for an optimal replacement of the proven weighing indicator DISOMAT® F. Summarised main technological features of the latest multi-talent electronics offspring of the DISOMAT® family are:

- legal-for-trade approval (6000d, multi-range and multi-division scale up to 3x 4000d)
- stainless steel housing
- integrated legal-for-trade memory (optional)
- intelligent Loadcell plug (dongle)
- on-board Ethernet interface (Profibus, DeviceNet available as options)
- USB-interface for external keyboard
- parameter adjustment via customer network (DISOPLAN® via Ethernet)

Small, compact and very cost-effective - a leading concept for today's and future applications, that will certainly pay-off for our customers.
The DISOMAT® family – in the past and today

Schenck weighing electronics have been introduced in the market since the 70th. The first unit brand names were: PIKOMAT®, DFM®, DIKOMAT®, GDM® and DISOMAT® 7S. The graph below shows all following weighing electronic generations starting from the production year 1978:

With this presentation we like to give to You an overview about the life-cycle of all our devices for static weighing. At the same time it visualises crucially the general technological progress in electronics up to today’s state of the art.

Our proposals for replacement here only are a general guideline. Please contact us directly in order to define in all details the optimal modern electronics for every single application.
Double frame weighing systems - solution without tie-rods!

Frequently, for in-process weighing systems such as ladle or scrap transfer cars conventional double frame solutions as shown on the photos below are realised. Those consist of standardised Loadcells and additional external tie-rods for the horizontal load transmission. In the harsh environment of steel production those tie-rods are critical due to the following reasons:

- Little movement, pollution and the high processing forces applied lead to unpredictable and uncontrollable shunt forces acting in parallel to the Loadcells over the long times of operation.
- Consequences of these shunt forces in the vertical measuring direction are reduced accuracy, reliability and frequent time-consuming maintenance works.

Schenck Process recommends for these applications the so-called integrated load transmitting points:
The graphics of a ladle transfer car with double frame shown on the previous page clearly visualises, that between the “blue” weighing frame and the “green” base frame apart of the “yellow” load transmitting points no further design elements are needed. This execution eliminates the described negative shunt force influences completely. Each of the four loading points is composed according to the graphics on the right side by one **Weighbeam DWB** completely fixed inside the steel structure, enabling to transmit additionally to the vertical measuring weight

- all horizontal loads and
- lifting forces,

applied for example during the set-in of the ladle.

Apart from the Weighbeams, those integrated load transmission points in double frames nowadays can also be realised using the Schenck Process **Weighdisc WDI**, that contains especially in case of limited space conditions further advantages. The graphics below displays such an integrated loading point, that in the same manor as described before is able to transmit all horizontal forces applied without negative effects on the weighing accuracy. For easy assembly, this solution is executed by simply laying the “blue” weighing frame on the weighing load point. An additional external hold-down completes the very maintenance-friendly design.

These examples demonstrate, that for new installations and revamping of in-process scales modern weighing solutions allow to renounce in conventional tie-rods: a valuable contribution to increase accuracy and at the same time to reduce maintenance costs and effort.

If in Your plant double frame weighing systems with tie-rods are still operative in the described areas, we would be pleased for any contact to check the improvement chances for the future operation of these scales.

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Advanced in-process weighing systems for steel production: accurate and reliable by maintenance-free design
**Introduction**

This article provides to production and maintenance departments of steel plants and to plant designers an overview over advanced weighing systems, used for example for liquid steel or scrap weighing, that offer high accuracy and reliability combined with crucially reduced time and money effort for maintenance.

Considering the trend of down-sizing maintenance departments going on in parallel with the steadily increasing requirements on productivity, all design improvements, that reduce maintenance on weighing systems, contain a high economical potential. Over the last years the following mechanical features have been developed and successfully executed especially for the various in-process weighing applications:

- design of special strain gauge Load cells,
- definition of best suited installation places for the weighing mechanics,
- continuous exploitation of field experience with installed systems worldwide as technical reference.

The totality of these elements contribute to the fact, that modern in-process weighing systems operate extremely accurate and reliable in the harsh environment of steel production, that is characterised by huge dynamic forces, high temperatures, significant contamination by dust and spillages as well as extremely restricted maintenance and repair access.

**The tasks of in-process weighing systems**

More than ever before today’s worldwide consolidation of steel industry is followed by the constant need for process improvement. Weighing systems have always largely contributed to economical and safe steel production: from the mass control and dosing of raw materials over the processing of hot metal and steel to the sale of finished products. Especially the in-process weighing systems, used for the internal control in the production area (scrap yard, Blast Furnace, Converter, EAF and Continuous Casting Machine) have to operate in an extremely harsh environment. With loads to be weight between 1 and 1,000t, these kind of scales should be mechanically designed for every particular use, leading frequently to solutions very different from conventional legal-for-trade scales like truck or platform scales.

In-process weighing systems generally are used for the following functions of the steel plant management:

- production control for stable quality parameters,
- determination and optimisation of the Yield inside one production unit,
- internal plant mass balancing, “invoicing” of services and production turnover between different production units.

Additional to these control functions reliable weighing systems contribute significantly to increase safety and profitability of the daily steel making process.

**Safety:**

Where large amounts of liquid hot metal and steel have to be transported between different processing areas, weighing equipment has an essential, safety-critical function in order to avoid spillages and accidents, for example during the weight-controlled filling of ladles. Only weighing systems that operate without any contact to the dangerous products can guarantee the necessary process safety.

**Profitability:**

Precise weighing systems crucially improve the profitability, allowing to feed the minimum of raw materials and alloys to achieve the desired steel quality respecting the chemical tolerances. An easy calculation example may demonstrate the huge benefit: an annual production of 1 Mio t alloyed steel should contain a final Molybdenum content of minimum 0.45%. The net steel mass as reference for the alloy calculation may be weight in a ladle transfer car or the overhead transport crane scale. Assuming that this scale first operates inside the unsatisfying error limits ± 1% of Full Scale, please find the calculation of the required annual Molybdenum mass:

<table>
<thead>
<tr>
<th>Correct weight 1:</th>
<th>Wc1 = 1,000,000t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displayed weight 1:</td>
<td>Wd1 = 990,000t – 1,010,000t</td>
</tr>
</tbody>
</table>

In order to guarantee the final alloy percentage in the melt the calculation of the alloy mass must refer to the maximum displayed weight:

| Required alloy mass 1: | Ma1 = 0.45% * 1,010,000t/a = 4,545 t/a |

Improving the weighing system performance to respect error limits ± 0.2% of Full Scale leads to the following result:

<table>
<thead>
<tr>
<th>Correct weight 2:</th>
<th>Wc2 = 1,000,000t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displayed weight 2:</td>
<td>Wd2 = 998,000t – 1,002,000t</td>
</tr>
<tr>
<td>Required alloy mass 2:</td>
<td>Ma2 = 0.45% * 1,002,000t/a = 4,509 t/a</td>
</tr>
</tbody>
</table>

The difference of 36 t Molybdenum (Ma1 – Ma2) represents an annual saving of about 1.5 Mio EUR. It is self-evident, that taking into account all different alloying elements multiplies that benefit. This simple example confirms convincingly, that precise and stable operating weighing systems are an efficient tool to increase the profitability of steel production. Additionally, availability of information about the
exact weight of materials is essential for gaining a better understanding and control of material balances, for example in order to identify and utilise improvement potentials: in the rolling mill a certain amount of material loss is inherent in the process between the annealing furnace and the finished, coiled-up bundle, resulting from de-scaling, cropping and other operations. These mass losses can be totalised over an extended time period and used as data base to optimise the efficiency of the production process. Another example for this approach to improve profitability by detailed weight information and analyse is the tracing and balancing of liquid steel from the converter over the ladle furnace to the beginning and the end of casting in the CCM. Weighing data also contribute to profitability in an indirect manner: the survey of the decreasing tare weight of all steel ladles caused by consumed refractories nowadays is an important input to optimise their repair intervals. In a similar way the load totalising memory implemented in modern crane scale electronics exactly mirrors the crane charging history and directly determines the allowed remaining operation time until the next crane maintenance. These examples demonstrate, than investing in weighing systems leads to a remarkable increase of profitability, easy to calculate in hard figures, that will pay-off in very short time periods.

Requirements for in-process scales
Difficult installation surroundings, for example in ladle transfer cars, ladle transport cranes or under huge scrap buckets mean, that very often the only externally visible part of an in-process scale is the large display. To achieve high mechanical stability of such heavy loaded weighing systems, the weighing mechanics is the key to success: depending on the specific application a suited combination of sensor choice and installation place is essential. The following requirements have to be considered for a proper design and dimensioning of in-process scales for steel production:

Forces
- high forces in the vertical measuring direction from 1 to 1,000t,
- additional – often unknown – dynamic forces in the vertical measuring direction frequently inherent in the process,
- high lift-off forces opposite to the vertical measuring direction,
- high disturbing forces in both horizontal directions.

Temperatures
- weighing systems in the liquid sector and at the input of the hot rolling mill are exposed to high thermal loading up to 200°C already under normal operating conditions,
- extreme temperature peaks occur during process accidents.

Contamination
- dust, dirt and slag deposits over the entire mechanical structure.

Operation
- difficult access to the mechanical components of the weighing system,
- ongoing production dictates minimum time windows for maintenance, inspection and repair.

Maintenance aspects
Unlike weighing systems requiring trade use certification, for in-process scales no prescribed maintenance intervals exist. Therefore significant cost savings can be achieved, if special attention is given to optimum maintenance properties. This applies especially taking into account the operational conditions significantly more severe compared to legal-for-trade scales. In-process weighing systems should work virtually maintenance-free for many years under the harsh conditions of use. As one customer once stated: the best weighing system is one, where you don’t even know, how it is realised internally! Even if in-process scales do not need do be periodically re-certified, according to DIN ISO 9001 regulations they are part of the plants Quality Management System. This use requires regular check and documentation of proper function and accuracy. For advanced solutions such controls generally are limited to a simple check weighing with a reference weight, confirming quickly the proper function of the weighing system and saving time for both maintenance and production specialists. Regarding in-process weighing systems for steel production a special focus has to be laid on the minimisation of maintenance features for the following reasons:
- in-process scales are installed in places with very difficult access,
- 24 hour production reduces the time windows for any maintenance and control work to a minimum, and
- ongoing reduction of service departments staff today asks for minimised maintenance requirements.

Under these specific conditions conventional weighing solutions often do not fulfil requirements with regard to accuracy, reliability and ease of maintenance sufficiently due to the following problems experienced in practice:
- mechanical destruction of Loadcells by overloading in the measuring direction,
- weighing errors or destruction of Loadcells resulting from missing or no more functional mounting elements, damaged by excessive horizontal loads,
overheating of Loadcells and connection cables,
weighing errors resulting from shunt forces on mounting elements such as tie-rods, bumpers and hold-downs, caused for example by the heat expansion of metallic structures,
sensitivity to slight changes of the stiffness of the steel/concrete foundation.

Improper working scales not only cause high costs for frequent calibration, control and mechanical checking. Moreover processing improper weighing data affects the efficiency and control of the total production as well as the target quality. The fundamentally different operating conditions in mind, Schenck Process started already in 1985 to develop special strain gauge based Loadcells and applications, the so called Direct Weighing Technologies, optimally suited to design advanced in-process scales for steel industry. It is the main issue of this article to demonstrate, that Direct Weighing Technologies reduce maintenance effort crucially and at the same time improve reliability and accuracy. In order to achieve that technological progress the following main features characterise Schenck Process Direct Weighing solutions:

- easy and simple integration of the weighing sensors inside existing mechanical structures with a minimum number of mechanical parts,
- minimised headroom requirement,
- high static and dynamic load transmitting capability in all directions,
- increased temperature operating range,
- error limit ± 0.1% of Full Scale,
- high repeatability, functional reliability and availability,
- maximum insensitivity against dust and slag contamination.

Advanced in-process weighing systems offer to the steel plant an increased production availability by minimised shutdown intervals for regular or emergency maintenance. Especially the mechanically optimal adapted solution is the key to success. Industrial experience with various successfully executed installations worldwide has proven, that state of the art in-process weighing systems represent an excellent investment, justified by increasing confidence in accuracy and reliability of weighing data and significant reduction of maintenance costs.

In the next chapter we like to present some typical application examples of advanced in-process weighing systems, offering a high degree of accuracy and availability achieved with minimum maintenance intervals. Many of these solutions are used as weighing standard for new plants by the international steel plant main contractors.

Examples of advanced mechanical solutions for in-process scales
To meet the above requirements the following design elements have to be optimised together:

- design and selection of the best suited sensors for each application,
- selection of optimum installation place, and
- design of the load application structure.

Example 1: Ladle transfer car and ladle turret scales
Ladle transfer cars are used for the transport, ladle turrets for casting of liquid steel. The ambient environment of the weighing systems is characterised by:

- high mechanical impacts during the positioning of the ladle support on the weighbridge,
- elevated temperatures due to radiation heat and heat conduction from the liquid hot metal or steel
- mechanical movement in operation with the permanent risk of cable damages,
- high contamination, particularly for ladle transfer cars (splashing slag during tapping and the secondary metallurgy).

Figures 1 and 2 show the mechanical integration of a weighing system inside a ladle turret: two Weighbeams DWB (figure 3) are screwed below each ladle support. Specific load directing plates adapted to the geometry of the ladle allow the transmission of all dynamic loads during positioning. Weighbridge (blue colour in figure 1) and steel structure (green) are only in contact with each other through the sensors. No additional bumpers, tie-rods or hold-downs exist. Concerning maintenance matters the extremely small dimension of that weighing arrangement reduces the risk of shunt forces under contamination to a minimum. Besides temperature heating of the weighing equipment is limited, because the huge ladle suspension plates provide protection from heat radiation. It is a further advantage, that, if necessary, the installation place of the weighing system allows rather easy access and repair. The Weighbeams of the DWB type are the key components of the Schenck Process Direct Weighing Technologies. Additionally to the benefits resulting from the suited installation place they represent with their own technological features the second main design element for high accuracy and reliability by minimised maintenance:
- simple fixed bolting between the weighing and the non-weighing structure, resulting in an eliminated risk of shunt forces,
- no mechanical adjustment,
- minimum number of installed parts,
- no moving parts, hence no wear,
- simple design and assembly,
- operating temperature range up to 150 °C,
- free of electrical destruction up to peak temperatures of 180 °C,
- special connector to avoid cable damages.

To further increase operational availability, each Weighbeam is equipped with an integral temperature sensor, enabling the temperature inside to be monitored at any time in the control room. This makes sense as preventive maintenance function in order to protect the Weighbeams from thermal damages caused by increasing temperatures at an early stage of time, for example by activating an additional air-cooling in critical situations. Each of these design elements contributes essentially towards ensuring high weighing accuracy, respecting the error limits ± 0.1% of Full Scale, guaranteed over long terms especially by the maintenance-free design.

**Ladle transport crane scales**

For the transport of liquid hot metal and steel in ladles weighing up to 600t ladle transfer cars and overhead cranes work together. Whether the integration of a weighing system inside the transfer car or the transport crane is the best solution in general terms cannot be stated, because it depends essentially on the process logistics and the possibilities to implement the required mechanical modifications. If the decision has been taken to integrate a weighing system inside the ladle transport crane, the following principle installation places can be considered:
- weighing inside the crane trolley, or
- weighing inside of the spreader beam/crane hook.

Experience with many ladle transport crane scales has proven, that from the maintenance point of view considered in this article weighing solutions integrated in the crane trolley offer a higher degree of safety and should therefore be preferred to spreader beam solutions for the following reasons:
- easier mechanical integration inside existing structures, so no need to manufacture a new spreader beam,
- unlike in the case of weighing systems integrated in the spreader beam there is no vertically moving energy and signal cable, which is always prone to failure by heat or mechanical destruction,
- the elasticity of the crane ropes significantly reduces dynamic loads,
- the big vertical distance from the ladle significantly reduces thermal loads.

The three main mechanical installation areas for weighing systems inside the trolley of large ladle transport cranes are illustrated in figure 4.
As the available headroom for existing cranes usually rules out the option of weighing the entire crane trolley by means of a double frame, only the solutions 2) and 3) will be outlined below.

Example 2: Weighing of the crane trolley in the area of the wheelbase
The design principle of this solution consists of the integration of several weighing units at the mechanical interface between trolley frame and wheelbase, in order to measure the total weight of the ladle transmitted over this section. It is self-evident, that this solution has to be capable to transmit all horizontal and vertical forces applied during normal crane operation. Each weighing unit consists internally of several Weighbeams DWB as presented before. The low required headroom of 220 mm, visible in figures 5 and 6, makes the solution extremely suitable for revamping existing crane trolleys. On the other hand, seen the huge vertical space and the investment for a heavy double weighing frame, its not surprising, that the wheelbase design is more and more also selected for new ladle transport crane weighing systems.

The main advantages of the wheelbase weighing concept in terms of accuracy, reliability and ease of maintenance are:
- maintenance-free installation through completely bolted weighing units,
- the existing mechanical connections/screw fixations of the crane structure are used with out any modification for the fixation of the weighing units,
- no moving parts, no adjustment or wear,
- no critical cable connections,
- the weighing system can easily be protected from heat radiation due to its compact and modular design.

Ladle transport crane scales designed according to this principle usually respect error limits ± 0.1 % of Full Scale.

Example 3: Weighing at the crane trolley inside the upper sheave block
The variety of crane executions forces designers of weighing equipment to keep an open eye for several possible variants at all times, finally finding a suitable solution concerning accuracy, costs of equipment and installation, downtime necessary for the weighing modification, installation height and maintenance properties. During the design of weighing systems for those heavy ladle transport cranes especially the required time for modification and maintenance has to be taken into account, as these cranes usually operate around the clock and minimum maintenance shifts will leave virtually no time for works on weighing equipment for months. The second application example for a crane weighing systems often is suited in cases, where weighing equipment at the wheelbase cannot be realised for reasons of mechanical adaptation.

Figures 7 and 8 show as alternative solution a very simple weighing installation inside the main hoist upper sheave block supporting plates.

The approach used for this weighing system is based on force sensors developed specifically for this application, the so-called Radial Force Sensor DRA (figure 9), installed inside the vertical supporting plates of the upper sheave blocks. These sensors measure and transmit radial loads applied by the crane cables, in this execution directly converting the supporting plates to a part of the weighing system according to the Direct Weighing Technology principle. Main features and design advantages of this solution are:
- no modification of the crane static’s,
- no modification of the main axle diameter and the sheaves used by the customer,
- no additional headroom,
extremely easy and fast retrofit: pre-assembly of the DRA sensors inside a new sheave block in the workshop, followed by welding this block onto the crane trolley steel frame.

With a view to the positive maintenance properties, this solution is essentially equivalent to weighing equipment installed in the area of the wheelbase particularly concerning the uncritical cable ways. Considering access to the mechanical structure and temperature protection, it has to be judged even superior. Upper sheave block weighing systems measure up to 90% of the ladle weight through the crane cable forces. To compensate the height depending effects of the non-weight cables to the cable drum, advanced weighing electronics provide a cable length compensation, enabling those scales to respect the error limits ± 0.2% of Full Scale.

Example 4: Scrap yard scales

Next to the steel works, scrap yards are another major application area with specific demands on in-process weighing equipment. Although thermal loading does not play a particularly important role in this part of the plant, high mechanical loads occur during charging of scrap for the converter or the EAF: frequently, the impact of a single block of scrap with a weight of 5t dropping from a height of 5m inside the unloaded basket must pass the weighing system safely. Other important conditions for weighing systems used for scrap charging are:

- during cleaning the weighing platform from scrap residues with the electromagnet, strong lift-off forces are applied on steel weighbridges,
- undamped dropping of scrap pieces will frequently also cause additional horizontal loads.

In the past, scrap weighing systems frequently were designed as raising platform scales, taking into account these difficult operational conditions: during dynamic loading the Loadcells were taken out of operation and therefore protected from excessive loads. Only at the expected end of the loading process a hydraulic system directed the weight over the Loadcells to the ground, so that the scrap mass charged up to this moment could be displayed. This solution contained the following fundamental disadvantages:

- no information about the weight already loaded during the charging process,
- difficult procedure to arrive at the desired set point,
- the entire hydraulic and control system requires significant maintenance,
- during normal production the mechanics and hydraulics in the concrete foundation are not accessible for control and maintenance,
- loss of time.

As this example shows, scrap yards require special weighing solutions ensuring highly accurate and low maintenance operation. Technical progress achieved over the last years
has provided such solutions. Basically, four possible installation places can be distinguished for weighing systems used on the scrap yard, depending on the underlying logistical concept:

- stationary on-floor mounted platform scales installed in a roofed scrap building, on which scrap buckets are positioned with the help of the huge scrap transport crane,
- stationary in-pit platform scales for outdoor installation, on which scrap buckets, chutes, trailers or wagons are positioned for charging and weighing,
- mobile scales integrated inside scrap transfer cars, trailers or carrier racks, and
- crane scales integrated inside the small scrap charging cranes.

Each of these places has its own advantages and inconveniences, so that the best weighing solution can only be determined by carefully analysing the exact conditions at site. Essential criteria with regard to design, maintenance and accuracy are:

Platform scale in the scrap hall: 
best solution, but requiring heavy investment.

Outdoor platform scale: 
risk of weighing errors and high maintenance effort due to blocking of the platform gap with small scrap parts and high contamination of the foundation pit by dirt.

Mobile weighing systems: 
reduced risk of shunt forces due to the installation place of the weighing components above floor, but need of additional elements for power supply and data transmission. 

Besides additional headroom is needed.

Loading crane scales: 
normally difficult to retrofit due to the cost and time effort connected with the modification. Significant weighing errors arise from the fact, that parts of the scrap weighed while hanging on the crane do not drop into the basket.

The following example shows a solution, that has been found to work properly both as in-pit platform and mobile scale:

Figures 10 and 11 show a simple design for a heavy scrap weighbridge 5 x 5 m based on Schenck Process Weighbeams. Also in this case the weighbridge is completely screwed onto the Weighbeams, ensuring that the weight of the scrap is accurately determined and displayed at all times of the loading process. Hydraulic equipment no longer is required and the simple execution without any tie-rods means, that the mechanical equipment works maintenance-free. The overall concept of this special platform scale includes the following additional elements to optimise the availability:

- high overload capability up to several times the Weighbeam nominal capacity, ensuring that the system will transmit even extreme impact loads without suffering damages,
- high permissible horizontal deflection of the weighbridge, resulting in a self cleaning effect of the weighbridge gap during operation.

As this example demonstrates, Direct Weighing Technologies allow integral weighing solutions, that provide the design features customers expect from advanced scrap yard weighing systems:

- total error limits ± 0.1 % of Full Scale,
- charging accuracy for scrap up to ±1 % of the net mass,
- uncritical transmission of impacts into the foundation,
- minimum inspection and maintenance requirements.

This last example completes the presentation of some mechanical weighing solutions conceived specifically for in-process weighing systems of steel industry. All solutions, consisting of sensors and surrounding mechanical arrangements, have been developed through longstanding, close cooperation between Schenck Process and its partners in steel industry. Various other applications have been optimised concerning the weighing performances in a similar manor using Direct Weighing Technologies: examples are torpedo railway scales or top hopper scales of Blast Furnaces.
As a comparison: conventional solutions for industrial weighing systems requiring legal-for-trade certification

The huge variety of weighing applications in steel plants has to be distinguished in legal-for-trade and in-process systems: legal-for-trade scales usually are located at the beginning of the production process for the purchase of raw materials and end for the sale of coils, bundles or finished sections. In these areas the ambient conditions for the installation of weighing systems do not pose major problems for the so-called conventional weighing solutions. They are designed as hopper scales, road weighbridges and crane or roller table scales with a weighing range between 1 and 100t. The weight is transmitted through a bridge structure and several legal-for-trade approved Loadcells with appropriate mounting elements (figure 12 and 13) to the ground. The installation example in figure 14 shows a typical coil scale with a weighing range of 35t and a legal-for-trade increment of 10 kg, executed with 4 Loadcells RTN 33t C5. This conventional solution for the weighing mechanics, based on Loadcells, Elastomer Mounts and external bumpers has proven to work extremely reliable in steel plants worldwide. It is cost-efficient, very accurate and requires only a minimum of maintenance. As all legal-for-trade scales need periodic re-certification at any rate, this will ensure that the operating status of the weighing system is routinely checked at regular intervals.

This simple example of a legal-for-trade coil scale is suited to point out the importance of a maintenance optimised design of industrial weighing systems: figure 15 shows one of the four supporting points of this scale, characterised especially by the distant arranged bumpers with a nominal clearance of 2 mm between the weighing (in blue) and the non-weighing (in green) bumper supports. If horizontal loads are applied on the weighbridge, for example during the positioning of the coil, after a horizontal deflection of the weighbridge of 2 mm these bumpers transmit all further horizontal forces directly to the foundation, thereby protecting Loadcells and Elastomer Mounts from damages.

The main advantage of this bumper arrangement in comparison to a tie-rod solution shown in figure 16 and used for the same purpose is the fact, that the clearance of the bumpers can be checked and if necessary adjusted at any time very easily. As long as this clearance is free, the 100% load transmission over the Loadcells during static weighing is guaranteed. It’s especially that clear statement, that makes maintenance so easy for bumper solutions and – on the other hand – often so difficult for tie-rod solutions. Tie-rods always represent a small, unfortunately unknown and invisible shunt force influence on the weighing accuracy, that is subjected to change during the years of the scale operation. This simple example already points out the consequences of a different mechanical scale design regarding especially maintenance matters. Industrial practice has shown moreover, that it makes special sense to distinguish...
the in-process weighing systems from the legal-for-trade systems presented above concerning maintenance matters. A principal argument for this approach is the fact, that in-process weighing systems have to work under entirely different operational conditions, as listed in the previous chapters.

The next chapter describes a number of features of advanced weighing electronics, that also contribute essentially towards increasing the functional reliability and availability of weighing systems and that enable preventive maintenance.

Last but not least:

features of modern weighing electronics

Additionally to the modern mechanical solutions today’s weighing electronics also contribute to increase operational reliability and reduce maintenance of in-process scales. The primary task of the weighing electronics is to filter and convert the analogue signals in the range of only a few Millivolts from the sensors to a stable digital signal. Due to the specific ambient conditions for in-process scales the Direct Weighing Loadcells still today are designed as analogue and not as digital Loadcells. Nevertheless the advantages of digitalisation are available inside Schenck Process scales as well.

As a first example for advanced weighing electronics figure 17 shows the DISOBOX®. Installed in a field housing it is designed for an installation close to the weighing mechanics. Inside the DISOBOX® every single Loadcell input signal is digitized and transformed into weight values by up to 8 independent A/D converters. The total weight is calculated based on these individual weights by simple software addition. The output cable transmits the single weights and the total weight directly to the customer control system by serial interface. The major advantage of this weighing electronics is the fact, that the weight measured by every single Loadcell is available in the control room at any time. This enables maintenance staff to detect assumed sensor performance deterioration, for example caused by cable damages, and to switch off this Loadcell electronically without costly and time-consuming intervention outside in the field, until repair or exchange is possible. Over and above this possibility of a manual intervention, the DISOBOX® also features automatic monitoring functions such as continuous zero signal checking, allowing to recognise automatically gradual growing errors for example caused by increasing shunt forces at a very early stage of time. By an automatically generated warning in case of discrepancies that self-check of every single Loadcell increases the operational reliability and accuracy of the weighing system significantly. Also, early recognition of potential future problems reduces the total maintenance effort and the risk of sudden failures with the associated serious impacts on production and control.

Different to the DISOBOX® the DISOMAT® B plus (figure 18) has been designed as a Weighing Terminal for applications with data exchanges by a scale operator for example in a crane cabin, requiring display and push buttons. Considering specifically maintenance aspect, first the integrated load totalising memory module enables the crane maintenance staff to receive an accurate report about the...
total mechanical load cycles applied on the crane mechanics over a defined period of time, allowing optimally expanded maintenance intervals depending on the varying loading conditions. A second major contribution in terms of ease of maintenance is made available by the DISOMAT® B plus advanced communication capabilities, for example through the Ethernet interface. In Web Server operation all essential data of the weighing system can be displayed by means of an Internet Browser, simply by selecting the associated IP address. Given the appropriate authorisation weighing data can be viewed throughout a company’s Intranet or even from outside through the Internet. This will provide to the maintenance workshop in charge of the weighing systems quick and easy information concerning the proper function of the most important in-process scales. Figure 19 visualises as typical in-process weighing application a modern ladle transfer car electronics. The combination of the DISOBOX® located in the field and the DISOMAT® B plus installed in the control room represents the maximum degree of preventive maintenance optimisation due to the following features:

- single sensor weight monitoring in the control room,
- emergency mode operation and calibration from the control room,
- wireless data transmission between the field and the control room, hence no endangered cable connection,
- safe digital data transmission.

Figure 19. Application example for a ladle transfer car weighing electronics
Conclusion
At the end of the presentation of some advanced solutions for in-process weighing systems we hope having been able to demonstrate, that especially for these kind of scales a higher effort in the mechanical and the electrical design in order to achieve largely accurate, reliable and highly maintenance-reduced weighing systems is more than justified by the increase of confidence in the scale performances, leading for the instrumentation or maintenance department to:
- a minimisation of maintenance and control time effort,
- an expansion of maintenance and control intervals, and
- minimised trouble-shooting and analyse actions.

The production department also benefits from those highly maintenance-reduced scales by an increased accuracy, reliability and availability of the scales for their original purposes in the process control. Confidence in weighing systems means, that the correct operation condition is confirmed by a proper and mechanically stable design over long times of operation, leading to minimised time and material effort for checking and re-calibration. Schenck Process in-process scales usually are only checked in time intervals of 3-6 month in the following simple manor:
- visual control of the surrounding of the scale mechanics,
- control of an eventual change of the offset signal stored inside the weighing electronics,
- one check-weighing with a test weight as confirmation of the still correct calibration.

A further benefit of maintenance-free scales is the reduced need for spare parts, as Direct Weighing solutions are not subjected to any mechanical movement or wear and withstand the normal harsh environmental conditions without any aging.

Especially the close cooperation between steel plant operators, plant designers and weighing specialists has ensured a continuous technological progress for in-process weighing systems within the last years. As system supplier we guarantee for the specified accuracy of the entire weighing system in operation, proven by the optimally suited mechanical and electrical components and our engineering as base for long year proper weighing operation regarding accuracy, reliability and maintenance effort. In-house development, design and production of Direct Weighing Technologies for steel industry enables Schenck Process to meet ever growing customer requirements, assuring to all partners involved a continuous benefit also in future.

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Weighing systems for long products:
It’s the detail that makes the difference!

The photo at this page shows a typical cooling bed at the end of the continuous casting machine for billets of up to 6 t weight and total length of up to 15 m. Additional to the fixed and the moving fence, that execute the billet transport and revolving the photo shows in one special position some other supporting fingers for the billets: they represent the upper part of a billet weighing system integrated inside the cooling bed.

Weighing systems at this position contribute significantly to an optimised productivity and efficiency of steel production, because the weight controlled operation of the torch allows to cut billets with a precisely determined weight even under the wear of the casting mould (leading to larger cross sections) or density variations.

Consequently the following rolling mill produces from these billets wire rod with exactly desired diameter and length, leading only to minimised waste, that has to be remolten. Further applications of long product scales are the entry of the rolling mill or its exit, for example for sampling a desired number of bars to bundles.

The following operating conditions pose high requirements to the installed weighing equipment:

- weighbridges with a length up to 15 m
- huge structural height
- light execution of the weighbridge steel structure
- little weighing range of maximum 10 t
- possible enhanced dynamic loads
- high product temperature of 400 °C and more
- strong heat radiation and temperature gradients
- desired accuracy up to ± 0,1 % of Full Scale, sometimes legal-for-trade requirements
- difficult access for installation and maintenance in terms of time and space.

On the following page we like to present the main elements of the Schenck Process solution, that guarantee best weighing results for this special weighing application:
Decisive for a high weighing accuracy is the choice of perfectly suited weighing components. Especially the huge elastic temperature expansion of the weighbridges represent the main task, easily to explain by the following example:

A weighbridge with a total length of 15 m is subject to a thermal expansion of 18 mm under a temperature change of only 100 °C. This unavoidable expansion not only charges all fixation elements. Moreover as the foundation usually is hardly heated up it has to be compensated by the weighing components, that are exactly arranged at the interface between the warmer and the colder areas of the total installation.

Schenck Process usually chooses the so-called Double Elastomer Mount as shown at the following drawing to fulfil with this special weighing task:

This Double Elastomer mount first of all consists of two standard elastomers VEN, that transmit and measure all vertical forces of deadload and product weight together with the Loadcell RTN in between to the ground. Designed with an expanded temperature range up to 110 °C and a relatively high nominal capacity this weighing unit is extremely elastic, shock adsorbing and insensitive against all kinds of installation tolerances. Nevertheless the most important feature is its ability to allow horizontal deflections of the weighbridge due to thermal expansion in relation to the ground foundation of up to 12 mm per loading point without negative effects on the weighing accuracy.

The photo on the right side shows such a loading point during installation under the weighbridge in a cooling bed: easy to recognise are the two black elastomers, surrounded by an external water-flown cooling unit. Above the upper elastomer additional heat isolation plates can be found, assisting to reduce the vertical heat flow in operation. Finally, the photo shows the connection of the weighing unit to the upper weighbridge and the lower steel foundation.

Good experience has been achieved also by using at that stage of the works the shown dummy-Loadcells, replaced by the original sensors at the very end of all installation, welding and adjustment works: a further contribution for an improved assembly security and Loadcell protection.

Further details of our total weighing solution for long product scales (not shown at the photo above) are suited designed bumpers for the transmission of horizontal overloads and hold-downs, that remain free of shunt forces in all stages of operation. Besides, we install as weighing electronics (like in more and more steel production scales) our A/D-converter DISOBOX, that at the same time displays and transmits the total billet weight to the production and additionally the loading per single loadcell as special preventive maintenance feature.

The weighing application „Long product scale“ with its high accuracy requirements in the range of a few kg confirms convincingly, that only an optimally adapted choice of the weighing elements guarantees high availability and accuracy in all stages of cold and hot operation. In contradiction weighing accuracy data determined under laboratory conditions and presented in general component data sheets have no practical meaning!

For these reasons our statement remains valid: Check Your application with the specialists of Schenck Process, because our worldwide experience is Your benefit!
Modernisation of weighing systems in spreader beams - state-of-the-art technology with minimal investment!

Ladle and coil transport cranes are the steel plant's most important logistic devices for safe and reliable material transport. Today frequently these older scales are not in operation anymore or do not represent state of the art equipment for the following reasons:

- high weighing errors or even scale destruction by mechanical overloads applied on Loadcells or mounts over the years of operation,
- damages of the weighing mechanics by high operation temperature,
- expiring spare part availability,
- missing features of modern data communication.

Based on the fact, that it represents an extremely high effort to integrate a completely new weighing system inside given mechanical structures of such huge cranes it is obvious, that the utilisation of the existing weighing space contains high potential for an economical and quick modernisation of both the weighing mechanics and the electronic data processing.

Integrated weighing systems in cranes moreover allow better than any other weighing system the establishment of material balances: starting from the empty ladle tare weight over the crude steel and alloy weighing to the pass-over of the finished steel to the continuous casting machine and finally the rest steel determination after the casting end. For this reason the big engineering companies often installed weighing systems in spreader beams during the erection period of many steel mills in the 70th and 80th of the last century.

At the following two pages we like to present some important elements of such a weighing modernisation of spreader beam scales.
First of all we check the actually installed weighing mechanics by analysing the installation drawings of the weighing supports (see attached example below) and - sometimes even more important - the operators experience with the old scale.

This analyse leads to the design of several geometrical adaptations for the new weighing supports based on new Loadcells.

Focus of this design process is the intention to replace the old system by the new one without any mechanical works on the crane by simple exchange, using the existing fixation interfaces again.

The drawing below shows the result of that engineering for the above shown old weighing support.

The choice of the very robust and compact Schenck Process Loadcells RTN usually allows to use the given installation volume offered by the old scale without need of additional headroom or new fixation interfaces. This leads to very simple solutions installed in extremely short shut down-times of the spreader beams.

During the engineering we also check the mechanical load transmission between the spreader sheave blocks and the main beam structure in all other non-weighing directions in order to guarantee, that the weighing modernisation maintains all force transmission ways, so that the initial calculation of the crane statics according to DIN 15018 remains valid unchanged.

A weighing modernisation performed following these principles only needs the following elements:

- standard Schenck Loadcells of the RTN family,
- a set of tailor-made adaptation plates,
- mechanical engineering for the calculation and the design of the new weighing supports.

The advantages of this easy revamping are convincing:

- Schenck accuracy guarantee up to an error limit of ± 0.1 % of Full Scale,
- service temperature up to 110° C (optional),
- maintenance-friendly solution with proven Loadcells for the harsh steel plant environment,
- security concerning the spare part supply for the next years of operation.

The following photo shows the installed weighing support of the modernisation example on the left side:
In completion of such a successful mechanical revamping we recommend to take the chance for an electrical modernisation as well in order to use the various features of modern weighing electronics in terms of safe crane operation and maintenance assistance.

The diagram at this side shows as example the general configuration of a modernised crane weighing electronics, which we have realised in cooperation with our representative SCHILTZ Graviconcept in Belgium.

It starts with the Loadcells on the spreader beam and ends with the transmission of the weighing data to the customers PLC at the ground:

Additionally to this executed reference the following functions of Schenck weighing electronics are available for a further improved crane and weighing operation:

- continuous supervision of all single Loadcell signals for preventive maintenance by the installation of a DISOBOX on the spreader beam,
- safe serial transmission of the weighing and process data between the spreader beam and the crane cabin,
- simple integration of locally existing interfaces like hand control panels by adjustable functional block configuration of the DISOMAT,
- Ethernet interface including remote access.

Existing devices, that have proven to work reliably in the harsh steel pant environment (as cable drums or Schenck supplied large displays) can be easily integrated in the total weighing arrangement.

The key element of this solution is the Weighing Terminal DISOMAT Bplus (that is followed since July 2007 by the new DISOMAT Tersus) with the following characteristics:

- collective load memory monitoring the crane charging history as input for optimised maintenance intervals of the entire crane mechanics,
- 2 separated measuring circuits enabling the detection of wrong hook engagement or eccentric suspended charges,
- radio transmission of the ladle weight and the casting speed (t/h) to different locations, simplifying cabling works between the crane and the ground,
- quick digital output contacts used for overload detection,
- modern field bus interface Profibus DP for the communication with the level two PLC.

This overview confirms, that not always huge investment is needed to improve the profitability of the steel making process significantly.

Specialised on crane scales for long years Schenck Process is prepared to work out tailor made modernisation kits for Your spreader beam weighing systems. With regard to the significance of reliable crane scales for steel production control, any investment will pay off in extremely short time.

To summarise: better stop complaining about problems of old crane scales and start to modernise them with us!