OPERATING INSTRUCTIONS

Belt Conveyor System

Manual 4

Design and Function

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CONTENTS

1 DESIGN AND FUNCTION

1.1 General description

The belt conveying system with a crushing station are used for transporting coal, mixed with xylitol, from a nearby open cast mining to an open air coal storage (not in scope of supply) inside a power plant.

The entire equipment consists of two main components:

- Crusher station for twin truck feeding,
- Belt conveyor system with 1 line for feeding the power plant open air stockpiles.

The crushing station is designed to feed an apron feeder by trucks from 2 sides. During unloading, trucks dump the coal-xylitol-mix through a hopper to the loading surface of the apron feeder. It starts and carries the material along a slope to its top point and discharges the load into a chute with a running impact crusher below.

Big lumps of coal and long pieces of xylitol are cracked inside the crusher immediately and the outgoing material falls through a chute to the loading table of the first belt conveyor with flowing sequence.

The continuous conveyor line consisting of conveyors U-1 to U-5 transports the material further to the secondary crushing equipment.

In the immediate vicinity of the crusher station, there is an operator cabin installed to control the handling process of the crushing station and the belt conveyor system. This cabin is designed for a continuous presence of an operator.

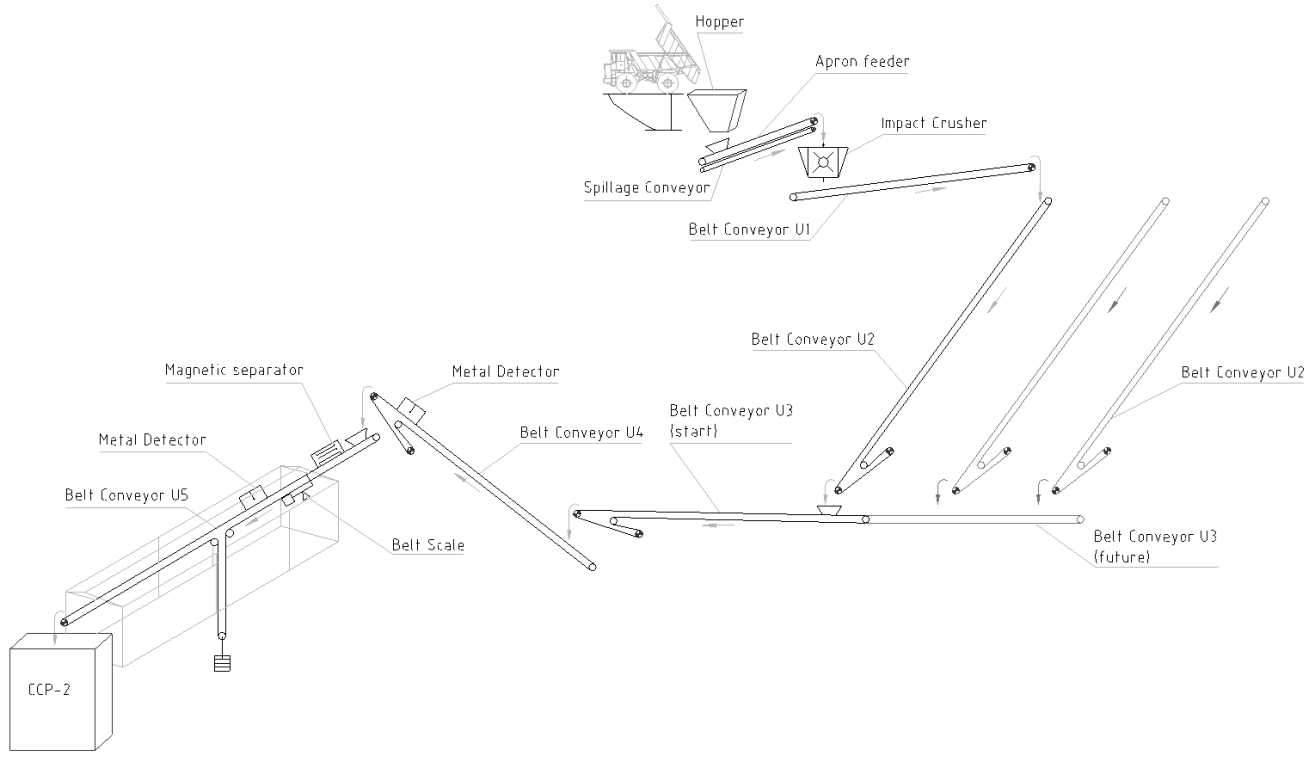

Figure 1: Flow sheet of crushing and conveying equipment

1.2 Belt Conveyors BC U1 – U5

The belt conveyor system performs transport of the coal received from the semi-mobile crushing equipment and delivers it to the secondary crushing equipment. The conveyor system consists of a continuous belt conveyor line involving conveyors U-1 to U-5 with a capacity of 1000 t/h and common final length of approx. 2901 m.

Almost at the end of the conveyor line, at the conveyor U-5, additional equipment is installed to check the incoming bulk material and to hold it clean. These are:

- 1 magnetic separator,
- 2 metal detectors before and after the separator and
- 1 belt scale.

The belt conveyors are the key drives for material handling. These drives are only switchable from the local repair switch to enable the repair operation outside of interlocking. Further, each belt conveyor can be separately locked in manual mode when the following conveyor is running. If all conditions are met, all conveyors in the conveying line in the semi-automatic operation start counter to the conveying direction and stop in the conveying direction.

In the locked and semi-automatic operation, separate and independent switching of individual promoters within the line is not possible. The sequence described above is observed in all cases.

In an emergency situation the system can be immediately shut-down by opening the emergency stop loop. This can be done by pulling a ripcord or by pressing a hardware red mushroom emergency stop button or a virtual red mushroom emergency stop button on a monitor in the control room.

The boot process is delayed by the respective start-warning time.

The stop operation is also delayed as a function of the belt speed and the effective length of the upper belt run to secure emptying of the conveyor in order to guarantee normal operation.

Figure 2: Example of belt conveyor

1.2.1 Intermediate Belt Conveyor U-1

1.2.1.1 General

The belt conveyor U1 is a functional component of the coal conveying system between the semi-mobile crushing station and the second crushing plant. From the crushing station the crushed coal is transferred to the belt conveyor U1 which transports the material further to the hopper of the belt conveyor U2.

The conveyor U1 is a relocated conveyor with an elevating structure. Depending on the mining progress, it can be shifted together with the semi-mobile crushing station. The belt conveyor U1 consists basically of the following components:

- Main frame,
- Drive station with drive pulley,
- Take-up station with take-up pulley,
- Feeding hopper,
- Discharge box with chute and adjustable baffle plate,
- Carrying idler stations, conveyor belt and belt cleaners,
- Safety devices.

1.2.1.1 Conveyor frame

The conveyor frame directing the conveyor belt between the drive station and the take-up station is designed as a welded and bolted steel framework construction. The steel construction rests in the rear part on a pontoon. On the other side the frame is held by a support which is connected with the main frame via pins. At the support bottom a pontoon is installed. Both pontoons are connected by an intermediate cross bar via pins. The rear pontoon has a centering and is thus located centrally under the crusher chute.

The conveyor between the crusher chute and the discharge box is protected by guard covers.

The conveyor is furnished with walkways which provide safe access to the components requiring regular maintenance as well as in case if corresponding operational, service and inspection works are needed.

Components which can endanger operation and maintenance personnel are equipped with effective and easily mount/dismountable protective devices/guards.

1.2.1.2 Drive station with discharge box

The drive station is located in the head part (heading section) of the U1. It includes a discharge pulley and a discharge box which are mounted on the conveyor frame. The discharge pulley is also the drive pulley whose pillow blocks are connected with the frame. The shaft end of the drive pulley is furnished with a coupling half.

The drive pulley is equipped with one drive unit which is installed laterally on the right side next to the frame. The shaft of the gear unit is connected with the shaft of the drive pulley via a flange coupling.

The power transmission between the motor and the gear unit is effected via a flexible coupling. The drive unit is mounted on a torsion-resistant swing base which is fastened to the drive pulley via the flange coupling and held on the main frame by a torque support on the motor side. A steel beam installed under the swing base serves as a support beam and shaft break safety. In addition, the drive unit is equipped with a backstop.

For cleaning of the belt after discharge, one pre-scraper and one main scraper are provided.

The discharge box is designed as a welded and bolted steel construction. Inside the discharge box, an adjustable baffle plate is provided to direct the coal flow centrally on the downstream conveyor belt U2. Sliding surfaces coming in contact with the transported material are lined with Hardox wear plates.

1.2.1.3 Take-up station

The take-up station is a spindle-operated tensioning station consisting of a moveable take-up sledge, a belt pulley and two take-up spindles. The conveyor belt coming from the drive pulley is guided in the lower run over carrying idler stations to the take-up sledge. The necessary belt pre-tension is reached by shifting the take-up sledge with the pulley by means of the spindles and spindle nuts.

The sledge and the take-up spindles are installed in the steel construction. The tension way is built by two longitudinal beams which are welded to the frame on both sides. Lift-off restraints hold the take-up sledge on the longitudinal beams. The pedestal bearings of the take-up pulley are fastened on the take-up sledge.

When installing the belt, the sledge should be brought into a definite position depending on the take-up way and secured there.

The necessary pre-tension of the conveyor belt is effected by a mechanical pre-stressing (note the belt sag!). If due to the belt elongation the belt tension changes, it must be corrected by the take-up spindles.

Before the take-up pulley, an inside belt cleaner is installed.

1.2.1.4 Feeding box

The feeding box is located in the tail part (end section of U1) and is used for receiving of conveyed material from the crusher chute and spillage from the apron feeder. The feeding box is designed as a stable welded and bolted steel construction which rests on the steel substructure.

The lateral walls of the hopper are lined with wear plates. The feeding box is sealed on both sides along the belt by adjustable rubber strips.

In the feeding zone, reinforced carrying idler stations are applied with idler spacing of 300 mm. The feeding idler stations are fastened by means of bolted connections.

The rubber curtains mounted in the feeding hopper are intended to reduce dust emissions.

The hopper is protected by covers.

1.2.1.5 Pulleys

The drive pulley has herringbone rubber lining and is supported by pillow blocks with anti-friction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

The take-up pulley has plain rubber lining and is supported by pillow blocks with antifriction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

1.2.1.6 Idlers

Rigid carrying idler stations consist of three idlers with equal length. The idlers are rigidly fastened to the idler supports. Rigid return idler stations consist of two idlers with equal length. The return run stations have rubber disc idlers in order to present very narrow surfaces for adhesion and thus to reduce the tendency for material build up. The idlers are rigidly fastened to the idler supports. Transfer points are equipped with impact idler stations with rigid fixtures.

Idlers of the same type are interchangeable. The bearings are lubricated for lifetime.

1.2.1.7 Belt cleaning equipment

The conveyor U1 is equipped with one primary and one secondary belt scrapers at the discharge pulley. A V-type plow scraper over the full belt width is installed in the return run before the take-up pulley, where material can be caught between the belt and pulley. The V-type plow scraper is mounted in a way preventing the steel frame from reaching the belt after the wiper rubber has completely worn down.

All pulleys in contact with the dirt side of the belt have a pulley scraper to remove adhering material from the pulley.

1.2.1.8 Safety devices

All exposed rotating parts with the exception of the idlers are protected against accidental contact by boxes, wire mesh guards or railings.

In cases of emergency the equipment can be turned off by means of emergency switches with relevant pull cords installed on both sides of the conveyor line. Actuation of the pull rope triggers immediately standstill of the conveyor and of the technologically interconnected conveying devices.

Visual and acoustic start-up signals are provided by a warning lamp and a horn.

Safety and warning devices include also:

- Material feeding of conveyor,
- Misalignment switch,
- Speed sensor and/or slip controller,
- Belt damage control,
- Filling level sensor of discharge station,
- Supplying of LED-lamps for the entire conveyor.

1.2.2 Relocated Belt Conveyor U-2

1.2.2.1 General

The belt conveyor U2 is a functional component of the coal conveying system between the semi-mobile crushing station and the second crushing plant. From the crushing station the crushed coal is transferred to the belt conveyor U1 which transports the material further to the hopper of the belt conveyor U2. The conveyor U2 carries the coal as far as the drive station and transfers it to the belt conveyor U3.

The conveyor U2 is a relocated conveyor with an elevating structure. Depending on the mining progress, it can be shifted together with the semi-mobile crushing station. The belt conveyor U2 consists basically of the following components:

- Conveyor frame,
- Combined drive and take-up station,
- Return station,
- Feeding hopper,
- Discharge box with chute and adjustable baffle plate,
- Carrying idler garlands, conveyor belt and belt cleaners,
- Safety devices.

1.2.2.2 Conveyor frame

The conveyor frame rests on steel sleepers and builds a connection between the return station and the combined drive/take-up station. The conveyor consists of definite number of frame sections which results from the conveyor length.

Each conveyor section includes four upper run garlands and two lower run garlands. The idler spacing in the upper run comprises 1,6 m and in the lower run 3,2 m. All conveyor sections have a system length of 6,4 m. Each section consists of two supports on which longitudinal stringers made from profile steel are mounted. The spacing between the supports makes 3,2 m. On the level of lower run garland suspension the supports are fastened to the frame construction by means of angles. The sleeper is also integrated in the supports of the conveyor sections.

The textile conveyor belt is supported in the upper run by three-piece garland stations and in the lower run by two-piece garland stations with rubber disc idlers. The entire conveyor frame is equipped with cable hooks and segmental arch covers.

The conveyor is furnished with walkways which provide safe access to the components requiring regular maintenance as well as in case if corresponding operational, service and inspection works are needed.

Components which can endanger operation and maintenance personnel are equipped with effective and easily mount/dismountable protective devices/guards.

1.2.2.3 Combined drive and take-up station

The drive station with the integrated take-up system is located in the head part (end of conveying line) of the U2. The supporting structure consists of welded and partly bolted sheet and sectional steel members. Between the drive station and the conveyor line, the belt is guided over a connecting bridge.

The drive station rests on pontoons, has two drive pulleys and three drive units. The three main frame sections are designed as framework constructions furnished with walkways. The belt is directed in the upper run over the conveyor frame towards the drive station.

On the discharge side of the station, a discharge pulley and a discharge box are mounted on the frame. The discharge pulley is also the drive pulley whose pillow blocks are connected with the frame. Each shaft end of the drive pulley is furnished with a coupling half.

The drive pulley on the discharge side is equipped with two drive units which are installed laterally on the right and left side next to the frame. The shaft of each gear unit is connected with the shaft of the drive pulley via a flange coupling.

The power transmission between the motor and the gear unit is effected via a flexible coupling. The drive unit is mounted on a torsion-resistant swing base which is fastened to the drive pulley via the flange coupling and held on the main frame by a torque support. In addition, the drive unit is equipped with a backstop.

For cleaning of the belt after discharge, one pre-scraper and one main scraper are provided.

The discharge box is designed as a welded and bolted steel construction. Inside the discharge box, an adjustable baffle plate is provided to direct the coal flow centrally on the downstream conveyor belt U3. Sliding surfaces coming in contact with the transported material are lined with Hardox wear plates.

The tensioning device is a winch-operated take-up station which includes a take-up carriage, rope sheaves and a driven rope drum. The carriage and the rope sheaves are positioned in the framework construction, the rope drum with the drive unit are fastened on the frame. The conveyor belt coming from the drive pulley is directed in the lower run over the second drive pulley to the take-up carriage. The belt loops around the take-up carriage pulley and runs back in the lower run of the conveyor.

The travel path of the take-up carriage is built by two longitudinal beams welded on both sides in the frame. The shiftable carriage whose take-up pulley deflects the conveyor belt has four travelling wheels. Further four horizontal wheels (excenter axis) hold the carriage in the track. The pillow blocks of the take-up pulley are screwed to the take-up carriage. Possible lifting of the take-up carriage is prevented by lift-off restraints. The travel way of the take-up carriage is secured by limit switches.

The take-up rope is reeved and directed from the rope drum over rope sheaves to the take-up carriage. When installing the belt, the carriage should be brought into a definite position depending on the take-up way and secured there.

The rope is provided with a rope force measuring device which controls and corrects the tension.

The necessary pre-tension of the belt is reached electrically (the value is set). If due to the belt elongation the value changes, the rope drum control is actuated and the value is adjusted.

The second drive pulley installed in the rear part is a one-side drive pulley whose pillow blocks are connected with the frame of the tail section. One shaft end of the drive pulley is furnished with a coupling half. The second drive pulley of the conveyor U2 is equipped with one drive unit which is installed laterally on the left side in the conveying direction next to the frame.

The shaft of the gear unit is connected with the shaft of the drive pulley via a flange coupling.

The power transmission between the motor and the gear unit is effected via a flexible coupling. The drive unit is mounted on a torsion-resistant swing base which is fastened to the drive pulley via the flange coupling and held on the main frame by a torque support.

1.2.2.4 Return station with feeding hopper

The return station with the feeding hopper is mounted on a pontoon. Under the pontoon an anchoring construction is embedded. The anchoring consists of a pivot plate, strings and two ground anchors. The pontoon and the pivot plate are connected via a pin of the plate.

The steel construction of the return station includes a frame and a hopper. It is a welded and partly bolted steel structure. The frame of the feeding hopper is fastened on the pontoon by means of bolted connections.

The feeding hopper is located in the tail part (end section of U2) and is used for receiving of conveyed material from the belt conveyor U1. It is designed as a stable welded and bolted steel construction which is connected with the frame via bolted connections. The lateral walls of the hopper are lined with wear plates. The feeding box is sealed on both sides along the belt by adjustable rubber strips.

The rubber curtains mounted in the feeding hopper are intended to reduce dust emissions. The hopper is protected by covers.

In the feeding zone, reinforced garland stations are applied. The feeding garlands are fastened by pins with wedges. In the outlet zone the upper run garlands are hung.

For belt directing, in the lower run a self-centring belt training station is provided as well as an inside belt cleaner and a diagonal scraper.

The return pulley is precisely aligned and fastened on the frame via pillow blocks. It is covered by a protective hood to prevent access to the rotating parts.

The return station with hopper are protected on both sides by guard gratings.

1.2.2.5 Pulleys

The drive pulleys have herringbone rubber lining and are supported by pillow blocks with anti-friction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

The return and take-up pulleys have plain rubber lagging and are supported by pillow blocks with antifriction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

1.2.2.6 Idlers

Both the carrying run and the return run of the conveyor belt are supported by garland idlers. The carrying garland stations consist of three idlers with equal length and hook suspension. The V-type return garland stations consist of two idlers with equal length and chain suspension. The return run stations have rubber disc idlers in order to present very narrow surfaces for adhesion and thus to reduce the tendency for material build up. Transfer points are equipped by impact idler garlands with bolt and wedge suspension.

Idlers of the same type are interchangeable. The bearings are lubricated for lifetime.

1.2.2.7 Belt cleaning equipment

The conveyor U2 is equipped with one primary and one secondary belt scrapers at the discharge pulley. A V-type plow scraper over the full belt width is installed in the return run before the take-up pulley as well as before the return pulley, where material can be caught between the belt and pulley. The V-type plow scraper is mounted in a way preventing the steel frame from reaching the belt after the wiper rubber has completely worn down.

All pulleys in contact with the dirt side of the belt have a pulley scraper to remove adhering material from the pulley.

1.2.2.8 Safety devices

All exposed rotating parts with the exception of the idlers are protected against accidental contact by boxes, wire mesh guards or railings.

In cases of emergency the equipment can be turned off by means of emergency switches with relevant pull cords installed on both sides of the conveyor line. Actuation of the pull rope triggers immediately standstill of the conveyor and of the technologically interconnected conveying devices.

Visual and acoustic start-up signals are provided by a warning lamp and a horn.

Safety and warning devices include also:

- Limit switches for take-up way limit,
- Travel limit of take-up carriage,
- Misalignment switch,
- Speed sensor and/or slip controller,
- Belt damage control,
- Filling level sensor of hopper,
- Supplying of LED-lamps for the entire conveyor.

1.2.3 Stationary Belt Conveyor U-3

1.2.3.1 General

The belt conveyor U3 is a functional component of the coal conveying system between the semi-mobile crushing station and the second crushing plant. The conveyor U3 receives the coal from the conveyor U2 through its hopper in the return station and carries it as far as the drive station where the material is transferred further to the belt conveyor U4.

The conveyor U3 is an extendable conveyor with a horizontal structure. Depending on the mining progress, it can be lengthened. The hopper of U3, the belt conveyor U2 and the semi-mobile crushing station with U1 are shifted according to the mining technological process. The U3 drive station and conveyor frame remain stationary. The free space between the end of the conveyor frame and the hopper is filled by corresponding number of conveyor frame sections.

The initial length is 363 m, the final length is 1100 m.

The belt conveyor U3 consists basically of the following components:

- Conveyor frame,
- Combined drive and take-up station,
- Return station,
- Feeding hopper,
- Discharge box with chute and adjustable baffle plate,
- Carrying idler garlands, conveyor belt and belt cleaners,
- Safety devices.

1.2.3.2 Conveyor frame U3 – initial length

The conveyor frame rests on steel sleepers and builds a connection between the return station and the combined drive/take-up station. The conveyor consists of definite number of frame sections which results from the conveyor length. The initial length of the conveyor U3 is 363 m.

Each conveyor section includes four upper run garlands and two lower run garlands. The idler spacing in the upper run comprises 1,6 m and in the lower run 3,2 m. All conveyor sections have a system length of 6,4 m. Each section consists of two supports on which longitudinal stringers made from profile steel are mounted. The spacing between the supports makes 3,2 m. On the level of lower run garland suspension the supports are fastened to the frame construction by means of angles. The sleeper is also integrated in the supports of the conveyor sections.

The textile conveyor belt is supported in the upper run by three-piece garland stations and in the lower run by two-piece garland stations with rubber disc idlers. The entire conveyor frame is equipped with cable hooks and segmental arch covers.

The conveyor is furnished with walkways which provide safe access to the components requiring regular maintenance as well as in case if corresponding operational, service and inspection works are needed.

Components which can endanger operation and maintenance personnel are equipped with effective and easily mount/dismountable protective devices/guards.

1.2.3.3 Extension of the belt conveyor U3

The conveyor is basically extended by adding a definite number of conveyor sections against the conveying direction. When extending the conveyor frame, the system length of the conveyor sections comprising 6,4 m each must be observed. The idler spacing in the upper run of 1,6 m must be adhered to as well. The number of electrical appliances must be adjusted.

With extension of the conveyor, the drive power also increases. The drive units 2 and 3 must be successively installed. Prior to this, the walkways including grating must be adjusted in the head part of corresponding drive side.

In the end the drive station U3 will be the same as the drive station U4.

1.2.3.4 Combined drive and take-up station

The drive station with the integrated take-up system is located in the head part (end of conveying line) of the U3. The supporting structure consists of welded and partly bolted sheet and sectional steel members. Between the drive station and the conveyor line, the belt is guided over a connecting bridge.

The drive station rests on pontoons, has two drive pulleys and three drive units in the final assembly stage. In the initial assembly stage only the drive pulley in the rear part of the drive station is equipped with a drive unit. Depending on the extension of the conveyor, the drive units 2 and 3 will be installed on the discharge side. The three main frame sections are designed as framework constructions furnished with walkways. The belt is directed in the upper run over the conveyor frame towards the drive station.

On the discharge side of the station, a discharge pulley and a discharge box are mounted on the frame. The discharge pulley is also the drive pulley whose pillow blocks are connected with the frame. Each shaft end of the drive pulley is furnished with a coupling half.

In the start phase no drive units are foreseen for the drive pulley on the discharge side.

For cleaning of the belt after discharge, one pre-scraper and one main scraper are provided.

The discharge box is designed as a welded and bolted steel construction. Inside the discharge box, an adjustable baffle plate is provided to direct the coal flow centrally on the downstream conveyor belt U4. Sliding surfaces coming in contact with the transported material are lined with Hardox wear plates.

The tensioning device is a winch-operated take-up station which includes a take-up carriage, rope sheaves and a driven rope drum. The carriage and the rope sheaves are positioned in the framework construction, the rope drum with the drive unit are fastened on the frame. The conveyor belt coming from the drive pulley is directed in the lower run over the second drive pulley to the take-up carriage. The belt loops around the take-up carriage pulley and runs back in the lower run of the conveyor.

The travel path of the take-up carriage is built by two longitudinal beams welded on both sides in the frame. The shiftable carriage whose take-up pulley deflects the conveyor belt has four travelling wheels. Further four horizontal wheels (excenter axis) hold the carriage in the track. The pillow blocks of the take-up pulley are screwed to the take-up carriage. Possible lifting of the take-up carriage is prevented by lift-off restraints. The travel way of the take-up carriage is secured by limit switches.

The take-up rope is reeved and directed from the rope drum over rope sheaves to the take-up carriage. When installing the belt, the carriage should be brought into a definite position depending on the take-up way and secured there.

The rope is provided with a rope force measuring device which controls and corrects the tension.

The necessary pre-tension of the belt is reached electrically (the value is set). If due to the belt elongation the value changes, the rope drum control is actuated and the value is adjusted. After extension the take-up forces must be set again.

The second drive pulley installed in the rear part is a one-side drive pulley whose pillow blocks are connected with the frame of the tail section. One shaft end of the drive pulley is furnished with a coupling half. The second drive pulley of the conveyor U3 is equipped with one drive unit which is installed laterally on the left side in the conveying direction next to the frame.

The shaft of the gear unit is connected with the shaft of the drive pulley via a flange coupling.

The power transmission between the motor and the gear unit is effected via a flexible coupling. The drive unit is mounted on a torsion-resistant swing base which is fastened to the drive pulley via the flange coupling and held on the main frame by a torque support. In addition, the drive unit is equipped with a backstop.

1.2.3.1 Return station with feeding hopper

The return station with the feeding hopper is mounted on a pontoon. Under the pontoon an anchoring construction is embedded. The anchoring consists of a pivot plate, strings and two ground anchors. The pontoon and the pivot plate are connected via a pin of the plate.

The steel construction of the return station includes a frame and a hopper. It is a welded and partly bolted steel structure. The frame of the feeding hopper is fastened on the pontoon by means of bolted connections.

The feeding hopper is located in the tail part (end section of U3) and is used for receiving of conveyed material from the belt conveyor U2. It is designed as a stable welded and bolted steel construction which is connected with the frame via bolted connections. The lateral walls of the hopper are lined with wear plates. The feeding box is sealed on both sides along the belt by adjustable rubber strips.

The rubber curtains mounted in the feeding hopper are intended to reduce dust emissions. The hopper is protected by covers.

In the feeding zone, reinforced garland stations are applied. The feeding garlands are fastened by pins with wedges. In the outlet zone the upper run garlands are hung.

For belt directing, in the lower run a self-centring belt training station is provided as well as an inside belt cleaner and a diagonal scraper.

The return pulley is precisely aligned and fastened on the frame via pillow blocks. It is covered by a protective hood to prevent access to the rotating parts.

The return station with hopper are protected on both sides by guard gratings.

1.2.3.2 Pulleys

The drive pulleys have herringbone rubber lining and are supported by pillow blocks with anti-friction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

The return and take-up pulleys have plain rubber lagging and are supported by pillow blocks with antifriction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

1.2.3.3 Idlers

Both the carrying run and the return run of the conveyor belt are supported by garland idlers. The carrying garland stations consist of three idlers with equal length and hook suspension. The V-type return garland stations consist of two idlers with equal length and chain suspension. The return run stations have rubber disc idlers in order to present very narrow surfaces for adhesion and thus to reduce the tendency for material build up. Transfer points are equipped by impact idler garlands with bolt and wedge suspension.

Idlers of the same type are interchangeable. The bearings are lubricated for lifetime.

1.2.3.4 Belt cleaning equipment

The conveyor U3 is equipped with one primary and one secondary belt scrapers at the discharge pulley. A V-type plow scraper over the full belt width is installed in the return run before the take-up pulley as well as before the return pulley, where material can be caught between the belt and pulley. The V-type plow scraper is mounted in a way preventing the steel frame from reaching the belt after the wiper rubber has completely worn down.

All pulleys in contact with the dirt side of the belt have a pulley scraper to remove adhering material from the pulley.

1.2.3.5 Safety devices

All exposed rotating parts with the exception of the idlers are protected against accidental contact by boxes, wire mesh guards or railings.

In cases of emergency the equipment can be turned off by means of emergency switches with relevant pull cords installed on both sides of the conveyor line. Actuation of the pull rope triggers immediately standstill of the conveyor and of the technologically interconnected conveying devices.

Visual and acoustic start-up signals are provided by a warning lamp and a horn.

Safety and warning devices include also:

- Limit switches for take-up way limit,
- Travel limit of take-up carriage,
- Misalignment switch,
- Speed sensor and/or slip controller,
- Belt damage control,
- Filling level sensor of hopper,
- Supplying of LED-lamps for the entire conveyor.

1.2.4 Stationary Belt Conveyor U-4

1.2.4.1 General

The belt conveyor U4 is a functional component of the coal conveying system between the semi-mobile crushing station and the second crushing plant. The conveyor U4 receives the coal from the conveyor U3 through its hopper in the return station and carries it as far as the drive station where the material is transferred further to the belt conveyor U5. Additionally, the drive station is equipped with a metal detector.

The conveyor U4 has a horizontal structure. It consists basically of the following components:

- Conveyor frame,
- Combined drive and take-up station,
- Return station,
- Feeding hopper,
- Discharge box with chute and adjustable baffle plate,
- Carrying idler garlands, conveyor belt and belt cleaners,
- Metal detector,
- Safety devices.

1.2.4.2 Conveyor frame U4

The conveyor frame rests on steel sleepers and builds a connection between the return station and the combined drive/take-up station. The conveyor consists of definite number of frame sections which results from the conveyor length.

Each conveyor section includes four upper run garlands and two lower run garlands. The idler spacing in the upper run comprises 1,6 m and in the lower run 3,2 m. All conveyor sections have a system length of 6,4 m. Each section consists of two supports on which longitudinal stringers made from profile steel are mounted. The spacing between the supports makes 3,2 m. On the level of lower run garland suspension the supports are fastened to the frame construction by means of angles. The sleeper is also integrated in the supports of the conveyor sections.

The textile conveyor belt is supported in the upper run by three-piece garland stations and in the lower run by two-piece garland stations with rubber disc idlers. The entire conveyor frame is equipped with cable hooks and segmental arch covers.

The conveyor is furnished with walkways which provide safe access to the components requiring regular maintenance as well as in case if corresponding operational, service and inspection works are needed.

Components which can endanger operation and maintenance personnel are equipped with effective and easily mount/dismountable protective devices/guards.

1.2.4.1 Combined drive and take-up station

The drive station with the integrated take-up system is located in the head part (end of conveying line) of the U4. The supporting structure consists of welded and partly bolted sheet and sectional steel members. Between the drive station and the conveyor line, the belt is guided over a connecting bridge.

The drive station rests on pontoons, has two drive pulleys and two drive units. The three main frame sections are designed as framework constructions furnished with walkways. The belt is directed in the upper run over the conveyor frame towards the drive station.

On the discharge side of the station, a discharge pulley and a discharge box are mounted on the frame. The discharge pulley is also the drive pulley whose pillow blocks are connected with the frame. Each shaft end of the drive pulley is furnished with a coupling half.

The drive pulley on the discharge side is equipped with one drive unit which is installed laterally on the right side next to the frame. The shaft of the gear unit is connected with the shaft of the drive pulley via a flange coupling.

The power transmission between the motor and the gear unit is effected via a flexible coupling. The drive unit is mounted on a torsion-resistant swing base which is fastened to the drive pulley via the flange coupling and held on the main frame by a torque support. In addition, the drive unit is equipped with a backstop.

For cleaning of the belt after discharge, one pre-scraper and one main scraper are provided.

The discharge box is designed as a welded and bolted steel construction. Inside the discharge box, an adjustable baffle plate is provided to direct the coal flow centrally on the downstream conveyor belt U5. Sliding surfaces coming in contact with the transported material are lined with Hardox wear plates.

The tensioning device is a winch-operated take-up station which includes a take-up carriage, rope sheaves and a driven rope drum. The carriage and the rope sheaves are positioned in the framework construction, the rope drum with the drive unit are fastened on the frame. The conveyor belt coming from the drive pulley is directed in the lower run over the second drive pulley to the take-up carriage. The belt loops around the take-up carriage pulley and runs back in the lower run of the conveyor.

The travel path of the take-up carriage is built by two longitudinal beams welded on both sides in the frame. The shiftable carriage whose take-up pulley deflects the conveyor belt has four travelling wheels. Further four horizontal wheels (excenter axis) hold the carriage in the track. The pillow blocks of the take-up pulley are screwed to the take-up carriage. Possible lifting of the take-up carriage is prevented by lift-off restraints. The travel way of the take-up carriage is secured by limit switches.

The take-up rope is reeved and directed from the rope drum over rope sheaves to the take-up carriage. When installing the belt, the carriage should be brought into a definite position depending on the take-up way and secured there.

The rope is provided with a rope force measuring device which controls and corrects the tension.

The necessary pre-tension of the belt is reached electrically (the value is set). If due to the belt elongation the value changes, the rope drum control is actuated and the value is adjusted.

The second drive pulley installed in the rear part is a one-side drive pulley whose pillow blocks are connected with the frame of the tail section. One shaft end of the drive pulley is furnished with a coupling half. The second drive pulley of the conveyor U4 is equipped with one drive unit which is installed laterally on the left side in the conveying direction next to the frame.

The shaft of the gear unit is connected with the shaft of the drive pulley via a flange coupling.

The power transmission between the motor and the gear unit is effected via a flexible coupling. The drive unit is mounted on a torsion-resistant swing base which is fastened to the drive pulley via the flange coupling and held on the main frame by a torque support.

1.2.4.2 Return station with feeding hopper

The return station with the feeding hopper is mounted on a pontoon. Under the pontoon an anchoring construction is embedded. The anchoring consists of a pivot plate, strings and two ground anchors. The pontoon and the pivot plate are connected via a pin of the plate.

The steel construction of the return station includes a frame and a hopper. It is a welded and partly bolted steel structure. The frame of the feeding hopper is fastened on the pontoon by means of bolted connections.

The feeding hopper is located in the tail part (end section of U4) and is used for receiving of conveyed material from the belt conveyor U3. It is designed as a stable welded and bolted steel construction which is connected with the frame via bolted connections. The lateral walls of the hopper are lined with wear plates. The feeding box is sealed on both sides along the belt by adjustable rubber strips.

The rubber curtains mounted in the feeding hopper are intended to reduce dust emissions. The hopper is protected by covers.

In the feeding zone, reinforced garland stations are applied. The feeding garlands are fastened by pins with wedges. In the outlet zone the upper run garlands are hung.

For belt directing, in the lower run a self-centring belt training station is provided as well as an inside belt cleaner and a diagonal scraper.

The return pulley is precisely aligned and fastened on the frame via pillow blocks. It is covered by a protective hood to prevent access to the rotating parts.

The return station with hopper are protected on both sides by guard gratings.

1.2.4.3 Pulleys

The drive pulleys have herringbone rubber lining and are supported by pillow blocks with anti-friction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

The return and take-up pulleys have plain rubber lagging and are supported by pillow blocks with antifriction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

1.2.4.4 Idlers

Both the carrying run and the return run of the conveyor belt are supported by garland idlers. The carrying garland stations consist of three idlers with equal length and hook suspension. The V-type return garland stations consist of two idlers with equal length and chain suspension. The return run stations have rubber disc idlers in order to present very narrow surfaces for adhesion and thus to reduce the tendency for material build up. Transfer points are equipped by impact idler garlands with bolt and wedge suspension.

Idlers of the same type are interchangeable. The bearings are lubricated for lifetime.

1.2.4.5 Belt cleaning equipment

The conveyor U4 is equipped with one primary and one secondary belt scrapers at the discharge pulley. A V-type plow scraper over the full belt width is installed in the return run before the take-up pulley as well as before the return pulley, where material can be caught between the belt and pulley. The V-type plow scraper is mounted in a way preventing the steel frame from reaching the belt after the wiper rubber has completely worn down.

All pulleys in contact with the dirt side of the belt have a pulley scraper to remove adhering material from the pulley.

1.2.4.6 Metal detector

The metal detector is arranged in the construction of the drive/take-up station U4 and aimed to activate the following magnetic separator in case of detection of metal parts or non-ferromagnetic foreign bodies in the flow.

The metal detector is composed of a frame with a search coil. The metal detector generates an electromagnetic field. If a metal object enters the field, the measurement signal is deflected in a certain direction. When the metal object leaves the field, a deflection occurs in the opposite direction. If both triggering limits of the signal are exceeded, the metal relay is switched.

An electronic circuit with an adjustable trigger enables the detection and display of metal elements.

1.2.4.7 Safety devices

All exposed rotating parts with the exception of the idlers are protected against accidental contact by boxes, wire mesh guards or railings.

In cases of emergency the equipment can be turned off by means of emergency switches with relevant pull cords installed on both sides of the conveyor line. Actuation of the pull rope triggers immediately standstill of the conveyor and of the technologically interconnected conveying devices.

Visual and acoustic start-up signals are provided by a warning lamp and a horn.

Safety and warning devices include also:

- Limit switches for take-up way limit,
- Travel limit of take-up carriage,
- Misalignment switch,
- Speed sensor and/or slip controller,
- Belt damage control,
- Filling level sensor of hopper,
- Supplying of LED-lamps for the entire conveyor.

1.2.5 Stationary Belt Conveyor U-5

1.2.5.1 General

The belt conveyor U5 is a functional component of the coal conveying system between the semi-mobile crushing station and the second crushing plant. The conveyor U5 receives the coal from the conveyor U4 through its hopper in the return station and carries it as far as the drive station where the material is transferred further to the CCH building of the next crushing station.

The conveyor U5 runs for the most part in a closed steel conveyor bridge. The bridge is elevated at an angle of 7.4° only in the first section (35 m) and has further a horizontal structure.

After the return station the magnetic separator for ferromagnetic parts is arranged. In the successive conveyor bridge a belt weigher and another metal detector with an adjacent selecting line are installed.

In case of danger emergency exits are provided on the left and right side of the steel bridge. The respective escape routes lead downstairs via ladders at the columns of the conveyor line.

In the event of fire the conveyor line is protected inside the steel bridge by a fire extinguishing system. The supply of the fire extinguishing system is located in a container installed at the column 5 of the conveyor bridge.

For the purposes of maintenance of the conveyor interior, a wash-down system is provided. Wastewater and roof drainage run downwards in a water collecting system to the main drainage connection.

The belt conveyor U5 consists basically of the following components:

- Conveyor frame,
- Drive station,
- Take-up station,
- Return station,
- Feeding hopper,
- Discharge box with chute and adjustable baffle plate,
- Magnetic separator,
- Belt weigher,
- Metal detector,
- Carrying idler garlands, conveyor belt and belt cleaners,
- Safety devices.

1.2.5.2 Conveyor frame

The conveyor gallery rests on the steel structure of the conveyor bridge and builds a connection between the return station and the drive station. The conveyor consists of definite number of frame sections which results from the conveyor length.

Conveyor frame sections accommodate the upper run idler stations at the distance of 1,2 m. The lower run idler stations are positioned at the frame supports at the distance of 3 m. All conveyor frame sections have a system length of 3 m. Each frame section consists of 2 stringers made from longitudinally arranged steel profile and mounted on the steel structure together with the frame supports at the distance of 3 m.

In the area of the CCH intermediate building the frame supports stand on mounting plates which were welded during the assembly on the anchor plates embedded in concrete.

The textile conveyor belt is supported in the upper run by three-piece carrying idler stations and in the lower run by two-piece carrying idler stations with rubber disc idlers. In the lower run belt training stations are additionally provided for correct belt running.

1.2.5.3 Drive station

The drive station is located in the head part of the U5. Between the drive station, the conveyor line and the return station, the belt is guided over idler stations which are fastened on the conveyor frame.

The drive stations rests on anchor plates embedded in the concrete floor (+15m level) of the CCH intermediate building.

The steel frame of the drive station is designed as a welded and bolted steel structure. It includes a discharge pulley and a discharge box which are mounted on the conveyor frame. The discharge pulley is also the drive pulley whose pillow blocks are connected with the frame. The shaft end of the drive pulley is furnished with a coupling half.

The drive pulley is equipped with one drive unit which is installed laterally on the left side in the conveying direction next to the frame. The shaft of the gear unit is connected with the shaft of the drive pulley via a flange coupling.

The power transmission between the motor and the gear unit is effected via a flexible coupling. The drive unit is mounted on a torsion-resistant swing base which is fastened to the drive pulley via the flange coupling and held on the main frame by a torque support on the motor side. A steel beam installed under the swing base serves as a support beam and shaft break safety. In addition, the drive unit is equipped with a backstop.

For cleaning of the belt after discharge, one pre-scraper and one main scraper are provided.

The discharge box is designed as a welded and bolted steel construction. Inside the discharge box, an adjustable baffle plate is provided to direct the coal flow centrally on the downstream conveyor belt U5. Sliding surfaces coming in contact with the transported material are lined with Hardox wear plates.

1.2.5.4 Take-up station

The take-up station is located at the column 5 of the conveyor bridge. It is a weight-operated tensioning station which consists of a take-up sledge, a dead weight box with ballast and a take-up pulley. The sledge and the dead weight box are arranged vertically in lateral guide rails.

The conveyor belt coming from the first deflection pulley is guided downwards to the take-up sledge where it wraps around the take-up pulley and runs again upwards to the second deflection pulley in the lower run of the conveyor line.

The guiding device of the take-up sledge is built by two longitudinal beams which are mounted on both sides of the conveyor bridge and fastened at the foot in concrete by means of anchor bolts.

The take-up sledge is equipped with a V-shaped inside belt cleaner which is mounted on the take-up frame. The sledge and the dead weight box have lateral guiding elements intended for lateral stabilising during vertical movement.

The pillow blocks of the take-up pulley are fastened in the take-up sledge. The take-up sledge and the dead weight box are bolted directly with each other.

For repair and maintenance works, an auxiliary platform is provided at the height of 5,35 m. In its middle, the platform has a through hole. The guiding rails are mounted laterally and the take-up sledge with the dead weight moves vertically through. The work platform is mounted sideways on two single supports. The other side of the platform is connected with the column 5 of the bridge. The platform is accessible via a walkway to the column 5 and a ladder installed at the column.

By reason of belt stretching and eventual movements during start-up and shutdown, the dead weight can move in the vertical direction between the limit values. The travel path of the take-up sledge is controlled and secured by limit switches.

1.2.5.5 Return station with feeding hopper

The return station with the feeding hopper is installed on an inclined concrete surface with anchor bolts.

The steel construction of the return station includes a frame and a hopper. It is a welded and partly bolted steel structure. The frame of the feeding hopper stands on stable support feet with anchor bolts installed in the bottom plates.

The feeding hopper is located in the tail part (end section of U5) and is used for receiving of conveyed material from the belt conveyor U4. It is designed as a stable welded and bolted steel construction which is connected with the frame via bolted connections. The lateral walls of the hopper are lined with wear plates. The feeding box is sealed on both sides along the belt by adjustable rubber strips.

In the feeding zone, reinforced garland stations are applied. The feeding garlands are fastened by pins with wedges. In the outlet zone the upper run garlands are hung.

For belt directing, in the lower run a self-centring belt training station is provided as well as an inside belt cleaner and a diagonal scraper.

The return pulley is precisely aligned and fastened on the frame via pillow blocks. It is covered by a protective hood to prevent access to the rotating parts. The protective hood accommodates sensors for slip control.

The cover of the feeding hopper and the sealed transfer point between the chute and the hopper facilitate reduction of dust emissions.

The return station with hopper are protected on both sides by guard gratings.

1.2.5.6 Pulleys

The drive pulley has herringbone rubber lining and is supported by pillow blocks with anti-friction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

The return, take-up and deflection pulleys have plain rubber lagging and are supported by pillow blocks with antifriction bearings with adapter sleeve. The shaft and pulley tube are connected by taperlock connections.

1.2.5.7 Idlers

Rigid carrying idler stations consist of three idlers with equal length. The idlers are rigidly fastened to the idler supports. Rigid return idler stations consist of two idlers with equal length. The return run stations have rubber disc idlers in order to present very narrow surfaces for adhesion and thus to reduce the tendency for material build up. The idlers are rigidly fastened to the idler supports. Transfer points are equipped with impact idler garlands.

Idlers of the same type are interchangeable. The bearings are lubricated for lifetime.

1.2.5.8 Belt cleaning equipment

The conveyor U5 is equipped with one primary and one secondary belt scrapers at the discharge pulley. A V-type plow scraper over the full belt width is installed in the return run before the take-up pulley as well as before the return pulley, where material can be caught between the belt and pulley. The V-type plow scraper is mounted in a way preventing the steel frame from reaching the belt after the wiper rubber has completely worn down.

All pulleys in contact with the dirt side of the belt have a pulley scraper to remove adhering material from the pulley.

1.2.5.9 Magnetic separator

The magnetic separator is a belt conveyor, which is orthogonally installed above the main conveyor U-5 behind the return station. In the middle between the lower belt and the upper belt, there is installed a strong electrical magnet which separates any ferrous parts from the conveyed material flow while the conveyor is running. From the area in the middle it carries the undesirable metal components sideward, where the magnetic field is lower, and lets them fall into a collection container for recyclable metal parts.

The metal piece discharge conveyor is hung in a steel construction with possibility of adjustment relatively to the conveyor line. The steel construction consists of an upper and lower part. The lower part is rigidly fastened in the concrete ground by means of anchor bolts in the bottom plates.

The steel construction is located at the beginning of the conveyor bridge and protected against atmospheric effects by a roof. For the purposes of maintenance and assembly of the magnetic separator, the upper part of the steel construction can be removed and laid down sideways.

The magnetic separator starts up only when the metal detector at the belt conveyor U-4 announces incoming metal and it runs for several minutes. The magnetic separator doesn’t run continuously together with the running conveyor U-5.

1.2.5.10 Belt weigher

The belt weigher is installed behind the feeding hopper U5. It is designed to acquire the instantaneous flow rate. The belt scale consists of at least one load cell, a speed sensor and the processing electronics. The load cell determines the weight of the load on a certain belt section (1 m), and the speed transducer measures the belt speed. The product of the two measured variables results in the current feed rate in t/h. The data provided are passed over to the existing interface of the PLC for further evaluation.

The belt weigher is fastened on the stringers of the conveyor frame and equipped in the upper run with two 3-piece idler stations for weight acquisition. The belt weigher is installed in the first frame section of the conveyor line which is located at the beginning of the conveyor bridge.

1.2.5.11 Metal detector

Behind the belt weigher, there is the second metal detector installed to recognize remaining undetected metal parts in the material flow. After detection of metal foreign bodies, a discharge station gets activated to facilitate identification of the relevant location.

In case of detection of metal parts in the material flow, the metal detector stops the belt conveyor.

The metal detector is composed of a frame with a search coil. The metal detector generates an electromagnetic field. If a metal object enters the field, the measurement signal is deflected in a certain direction. When the metal object leaves the field, a deflection occurs in the opposite direction. If both triggering limits of the signal are exceeded, the metal relay is switched.

An electronic circuit with an adjustable trigger enables the detection and display of metal elements.

An easy access to the conveyor is provided in the selecting line section.

1.2.5.12 Safety devices

All exposed rotating parts with the exception of the idlers are protected against accidental contact by boxes, wire mesh guards or railings.

In cases of emergency the equipment can be turned off by means of emergency switches with relevant pull cords installed on both sides of the conveyor line. Actuation of the pull rope triggers immediately standstill of the conveyor and of the technologically interconnected conveying devices.

Visual and acoustic start-up signals are provided by a warning lamp and a horn.

Safety and warning devices include also:

- Limit switches for take-up way limit,
- Misalignment switch,
- Speed sensor and/or slip controller,
- Belt damage control,
- Filling level sensor of hopper,
- Supplying of LED-lamps for the entire conveyor.