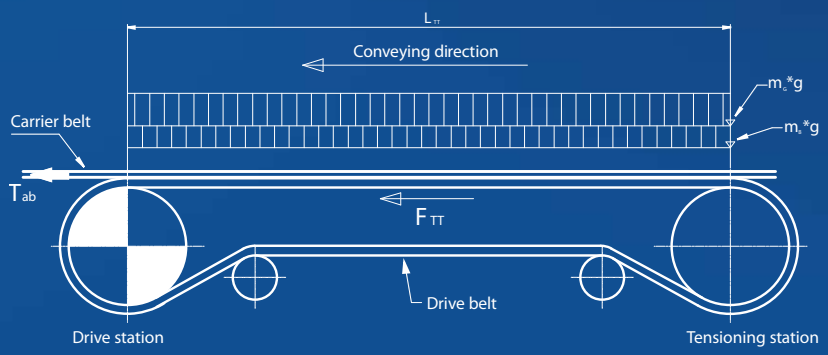
HESE TT-INTERMEDIATE DRIVE TECHNOLOGY



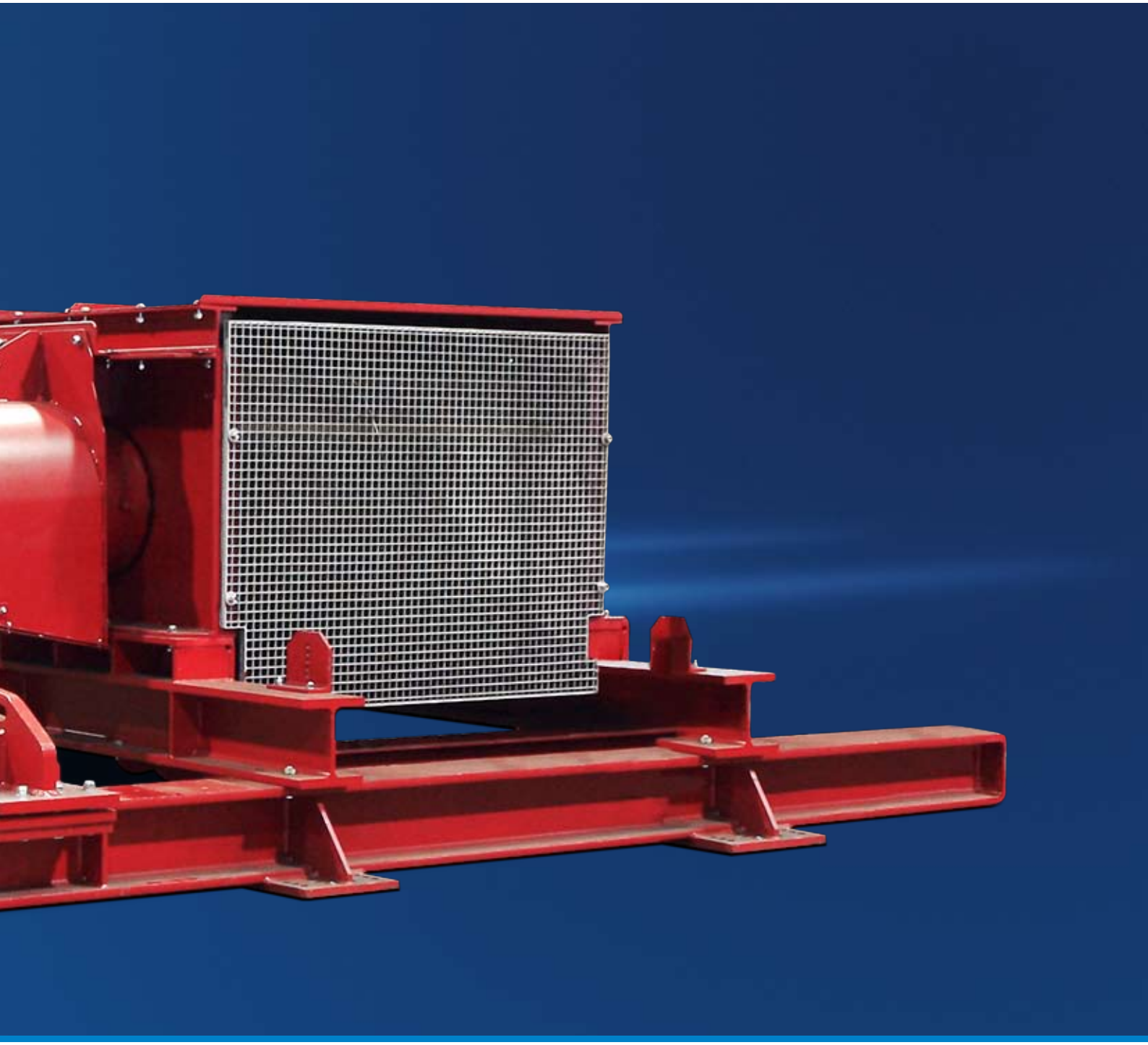
HESE
Maschinenfabrik

HESE TT-INTERMEDIATE DRIVE

Development and concept

In 1975 we started with the development and manufacturing of TT- drives for the western German coal mining. First the advantages of lengthening the belt conveyor systems in the coal haulage ways behind the longwall face were used. In the middle of the eighties large conveyors were also equipped with TT-drives. The advantages for the operators were the connection of a couple of short plants to one single belt conveyor unit, the use of smaller sizes for pulleys, drives and engines in larger axis-centre distance, the use of belts with lower stability and continuous belt conveyor units without intermediate transfers.

HESE
Maschinenfabrik

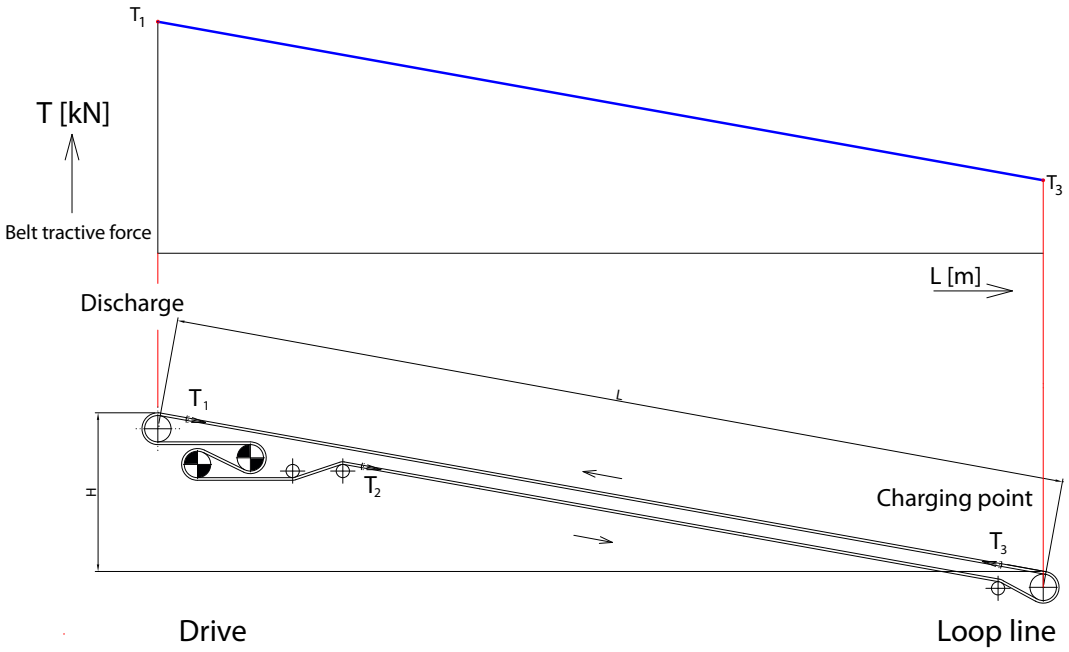


Since the beginning of the nineties all underground large belt conveyors have been equipped with TT-drives. Furthermore, the opportunity was used to improve the capacity of old, conventional plants by implementing TT-drives without changing the existing drive and without replacing the belts.

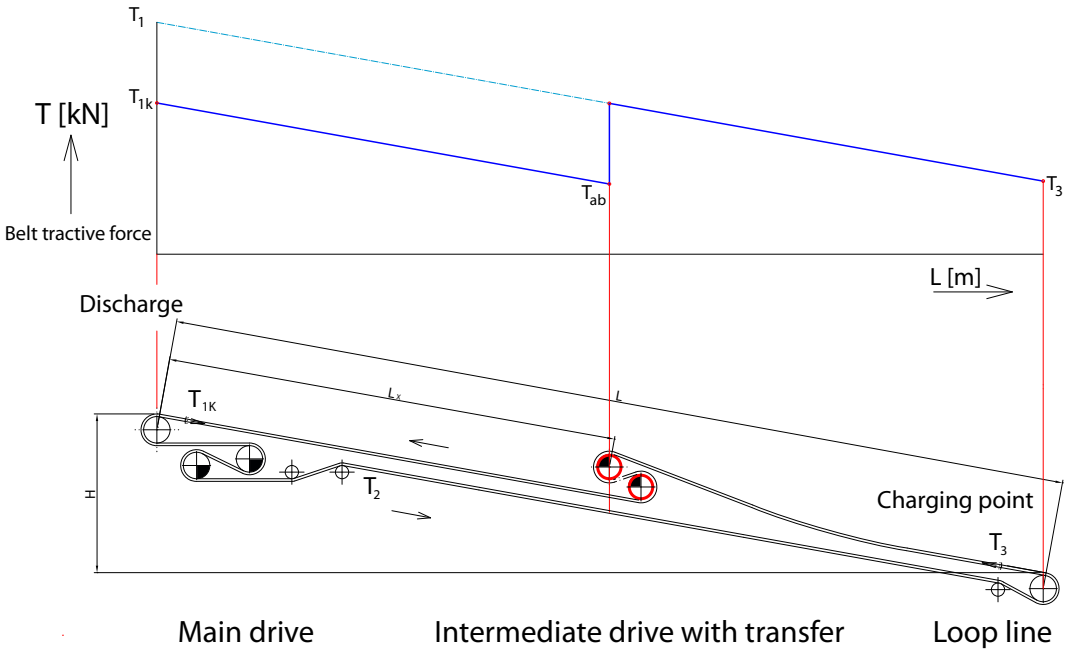
TT-drives have stood the test even under difficult conditions in underground sites.

TT-drive systems (carrier belt-drive belt)

CONVENTIONAL BELT CONVEYORS



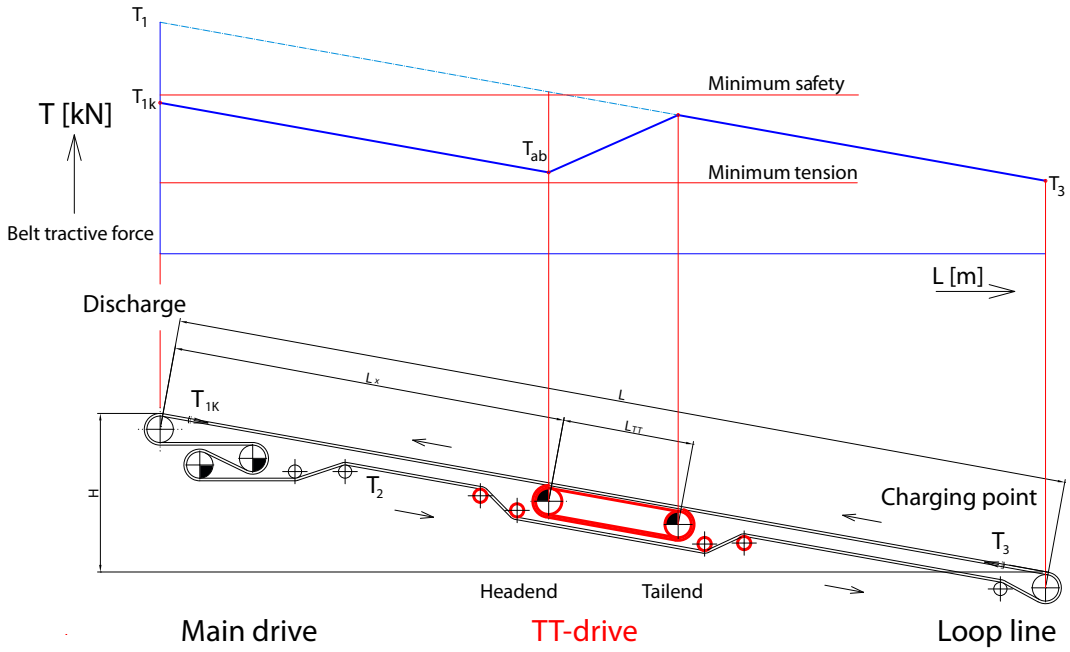
BELT CONVEYOR WITH INTERMEDIATE DRIVE



HESE
Maschinenfabrik

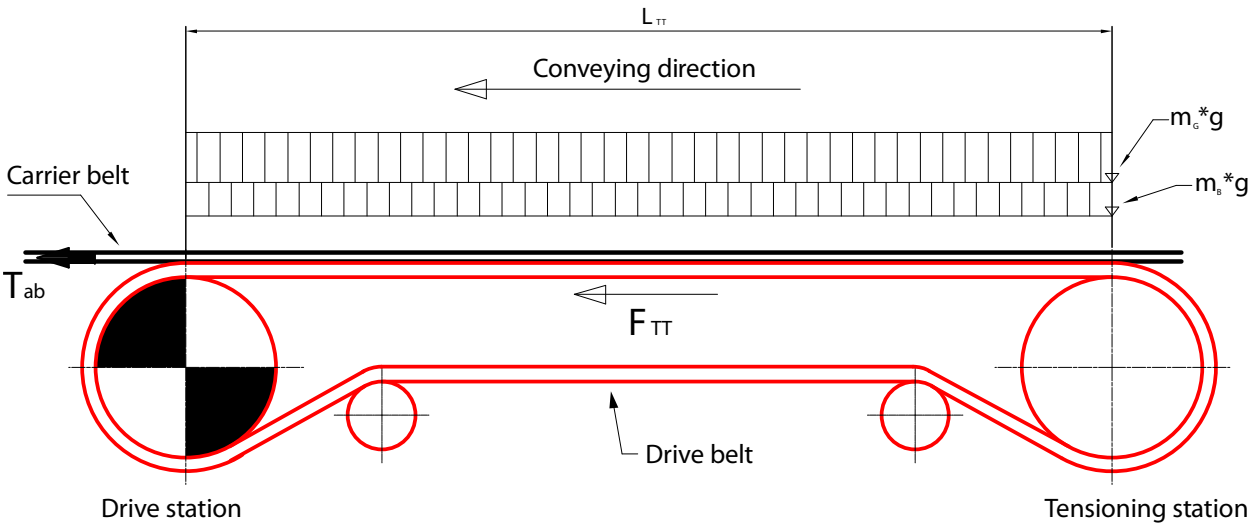
BELT CONVEYOR WITH HESE TT-DRIVE

Due to the division of the installed drive capacity, the maximum belt tractive force at the discharge is reduced from T1 to T1K. An intermediate transfer is not necessary. More than one TT-drive is possible.



The intermediate drive, here called TT-drive, is a belt conveyor with head- and tail station that is integrated in the actual belt conveyor in a way that the return side of the carrier belt with the material, lays on the upper belt of the TT-drive belt. Head- and tail station of the TT-drive can be driven; one station has to be tensible. The power transfer of the TT-drive power is actuated by adherence (friction) onto the carrier belt.

Power transfer carrier belt – drive belt



The power transfer of the drive belt onto the carrier belt is actuated by adherence (friction).
The most important factors for determining the needed drive belt length LTT are

- Belt volume/weight carrier belt m_B [kg/m]
- Loading volume/weight m_G [kg/m]
- Discharge force carrier belt T_{ab} [kN]
- Friction coefficient m [-]
- Plant set up concave/convex
- Pitch angle α [°]

Additionally, the location of the TT-drives dependent on the plant set up is essential.
Plant set-ups by Maschinenfabrik Hese GmbH have always been operated without power transfer problems.

Moisture and the usual dust contamination in underground systems have never led to a breakdown of the plant. Drive belt lengths never had to be extended later.

HESE
Maschinenfabrik

HESE TT-INTERMEDIATE DRIVE TECHNOLOGY

CARRIED OUT MEASURMENTS

Drive pulley diameter	up to 1500 mm
Belt width	up to 1600 mm
Drive capacity per TT- drive	up to 3 x 500 kW
Drive capacity of the complete plant	up to 4000 kW
TT-length	100m up to 400m
Drive belt stability	up to 2500 N/mm
Carrier belt stability in revamped plants	up to 5000 N/mm
Number of TT- drives in one plant	up to 4 Stück

CURRENT PROJECTS

Belt width	up to 2400 mm
Drive capacity per TT- drive	up to 3 x 2500 kW
Carrier belt stability	up to 7800 N/mm

BELT TYPES

Belts with textile tie beams as well as steel cord belts are used. The combinations are either textile/ textile or steel/steel. Different levels of stability can be combined.

DRIVE UNITS

All types of drive units have already been used: asynchronous motors with fixed filled fluid turbo couplings, ditto with dischargeable fluid turbo couplings, asynchronous motors with Thyristor control, ditto frequency control, drives with CST engine, re-entry plants with fixed coupled asynchronous motors.

CONTROLLING AND MONITORING

Generally the controlling is like the controlling of a conventional belt conveyor with more drives. In monitoring two more aspects need to be considered in comparison to a conventional plant:

- Skew- and traction control drive belt
- Pre-tensioning drive belt

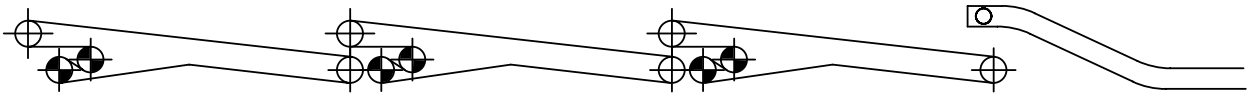
CHARACTERISTICS OF THE HESE TT-DRIVES

- Compact construction
- Robust, mining adequate design
- Few components
- Quick and easy assembly

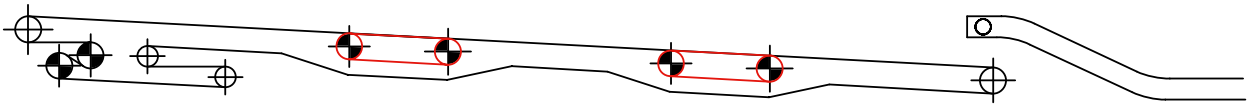
Implementation of TT-drives in underground belt conveyors

CONTINUOUS OPERATING/LENGTHENING/SHORTENING OF PLANTS IN COAL HAULAGE WAYS

Conventional drive technology



HESE TT-drive technology
same belt quality & same drive units (pulley, engine, motor)



The more the mining advances the belt conveyors need to be either lengthened or shortened in coal haulage ways. To commence further with the standard units and the usual belt qualities of these belt conveyors, the only possibility up to just recently was to separate the conveyor distance into a couple of short plants. This led to the fact that even on straight stretches more plants had to be implemented next to each other.

When implementing TT-drives such a plant can be continuously operated from charging to discharging, without employing higher belt stability and the drive units can remain of standard size.

Decisive advantages in comparison to single plants:

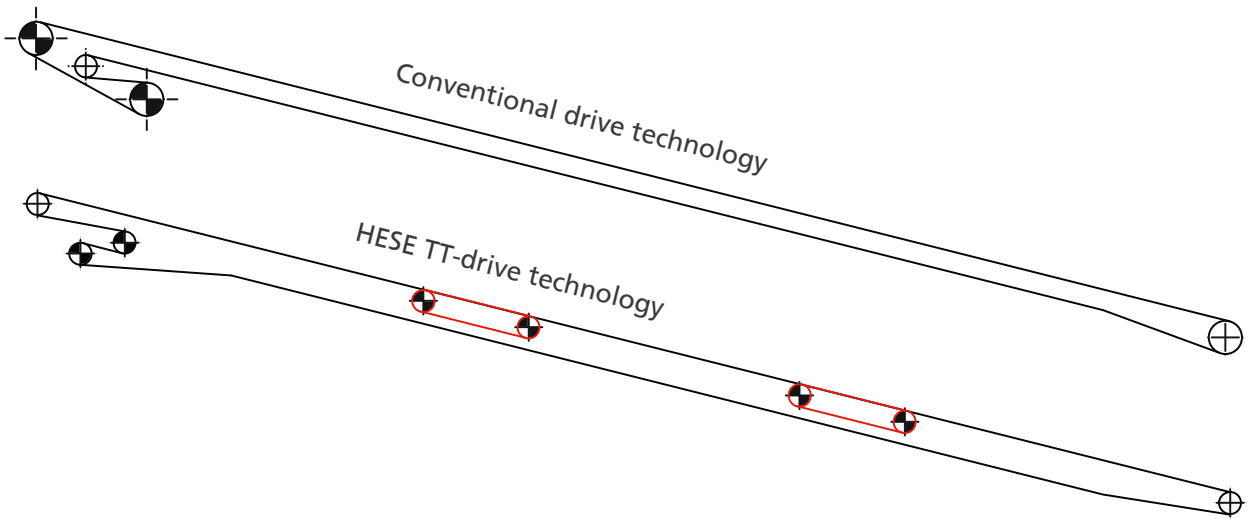
- Saving transfer points
- Less dust
- Just one storage loop for the whole mining distance
- Low graining
- Continuous passenger transportation
- Use of standard technology and standard belts

This technology is used in all German coalmines.

HESE
Maschinenfabrik

FIXED BELT CONVEYORS WITH HIGH PERFORMANCE DEMAND

TT-drives can also be implemented in fixed belt conveyors. The picture below shows the diagram of a giant mining plant for a mining hill.



Above you can see the conventional system with head drive. When high lifts and high conveyor capacities are demanded, steel cord belts of high stability and big drive units are necessary. The head drive needs a big mine excavation with appropriate foundations or bearing structures. In contrast, when using TT-drives, like shown in the picture below, substantially smaller units and lower belt stability is needed.

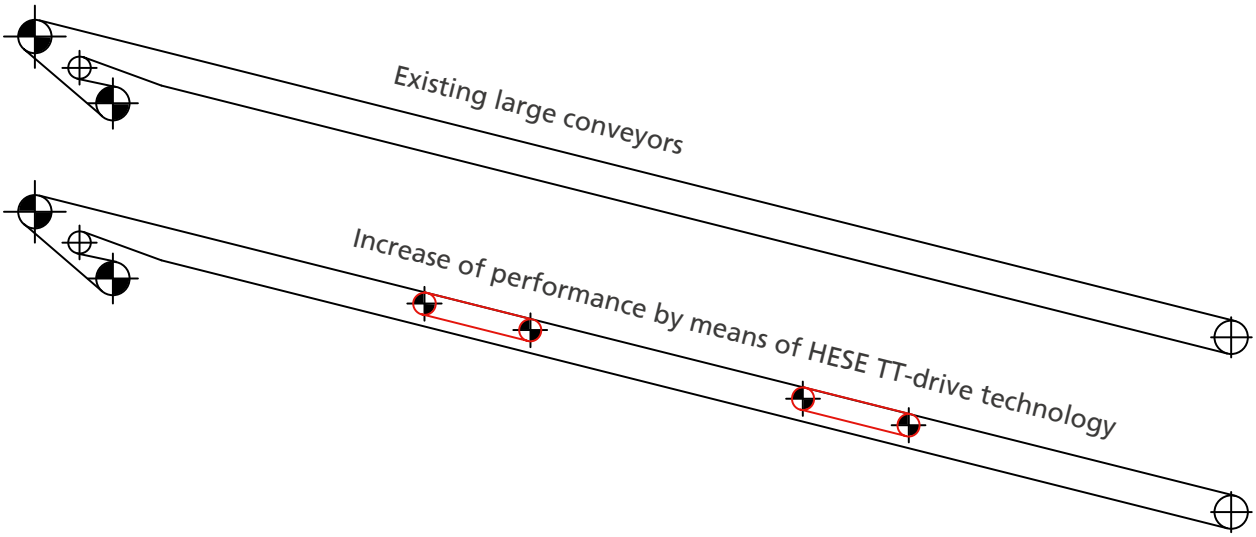
Advantages of plants with TT-drive:

- Lower belt quality, perhaps textile belts instead of steel cord belts
- Smaller drive units (pulleys, engines, motors in standard sizes)
- Smaller mine excavation for the head drive
- Easier transport of the units
- No additional transfer points like when using intermediate drives with mock transfers, therefore
  - Belt protection
  - Avoiding dust
  - Continuous passenger transport on carrying and return side

Since the beginning of the nineties all new belt conveyors in the Ruhr have been equipped with TT-drives. Some of them have been operating for more than 10 years.

INCREASE OF CONVEYING CAPACITY OR EXTENSION OF BELT SERVICE LIFE (REDUCTION OF MAX. BELT FORCES IN EXISTING LARGE CONVEYORS)

TT-drives are also used to increase the performance of existing belt conveyors.
Below you see the diagram of an existing large belt conveyor.



If it is necessary to increase the conveying capacity of such a plant because of operational reasons, a performance increase is necessary that means higher belt stability and a strengthening of the centre drive in conventional plants. Performance increase by means of rear drive is only successful in exceptional cases. By implementing TT-drives this problem is solved economically. The existing head drive and the belt stay unchanged. The TT-drives can be assembled in short stand still periods when preparations have been made accordingly. The drive belts are, according to the installed capacity of the TT-drive, of low stability and thus the TT-drive does not need the same drive pulley diameter as the head drive. Belt speed and the characteristics of the drives are to be considered.

We often have successfully and economically installed such plants; sometimes under difficult mining conditions and they have nevertheless been commissioned without any problems.

Advantages:

- Increase of conveying capacity on short term without change of belt manufacture and head drive
- Longer belt service time due to reduction of drive capacity at the head drive
- Decrease of max. belt tractive force
- No intermediate transfer points

HESE Maschinenfabrik

EXAMPLES OF PLANTS RUNNING WITH HESE TT-DRIVES

Nr.	Plant	Belt width [mm]	Capacity [t/h]	Length [m]	Höhe [m]	Height [kW]	1. Main-dr. [kW]	2. booster-drive [kW]	3. booster-drive [kW]	Belt [N/mm]	Running time
1	Bandberg Ostberg	1000	1350	1850	350	4 x 300	2 x 132	2 x 132	2 x 132	St 3500	1978 - 1989
2	Bandberg L 1	1200	1500	1045	105	4 x 90	2 x 90	2 x 90	3 x 90	1250	1979 - 1995
3	Verbindungsband NO-Zoll	1200	1560	4790	111	3 x 132	3 x 132	2 x 132	2 x 132	St 1250	1983 - 1987
5	Förderberg FM 1	1200	1500	893	205	3 x 160	2 x 160	2 x 160	2 x 160	St 1600	1989 - 2000
6	Förderberg O 1	1400	3500	1620	2	2 x 160	2 x 160			1250	1989 - 1994
7	Verbindungsband Ostansch.	1200	1500	2452	223	3 x 160	3 x 160	2 x 160	2 x 160	1600	1990 - 1997
8	Bandberg Zentr. Fb.	1200	1500	1703	316	3 x 160	3 x 160	3 x 160	3 x 160	1600	1991 - 2000
9	Bandberg1120 mS.	1200	1300	1450	204	3 x 160	2 x 160	2 x 160		2000	1992 - ..
10	Bandberg Ida/Röt.	1200	1000	1140	255	2 x 160	2 x 160	2 x 160	2 x 160	1250	1993 - 1998
11	Bandberg SW 22	1400	3800	870	144	4 x 250	4 x 250			2000	1994 - ..
12	Verbindungsband MRG BC2	1000	1000	2572	37	2 x 90	2 x 90	2 x 90		1000	1994 - 2001
13	Bandberg FB Ost	1200	3000	1480	330	3 x 250	4 x 250	4 x 250	4 x 250	2000	1997 - 2000
14	KA BH 537	1400	2600	2050	-80	2 x 100	2 x 100			1250	1997 - 1999
15	Verbindungsband A1	1200	1600	2525	10	2 x 132	2 x 132	2 x132		1250	1999 - 2008
16	Bandberg B1	1400	4100	1470	124	3 x 250	3 x 250	4 x 250		1250	1999 - 2008
17	KA 8/8	1200	2500	1600	-168	1 x 250	1 x 250	1 x 250		1250	2000 - 2003
18	Hauptförderberg	1200	1880 (1500)	1668	390	4 x 560	2 x 250			ST 5000/1250	2001 - ..
19	Bandberg V3	1400	1600	1530	206	3 x 200	3 x 200	3 x 200		ST 1600	2001 - ..
20	Bandberg D 382	1400	2900	2140	209	4 x 250	4 x 250	4 x 250		2000	2003 - ..
21	Bandberg NW 2	1400	3200	1810	258	3 x 500	3 x 500	(2 x 500)		2500	2004 - ..
22	KA 8/9	1400	3000	1426	-200	1 x 500	1 x 500	1 x 500		2000	2004 - ..
23	KA 5710	1400	2600	1570	-85/+34	1(2) x 250	2(1) x 250			1250	2005 - ..
24	KA G0110	1200	1800	3132	-40 +92	1 x 250	1 x 250	1 x 250	1 x 250	1250	2006 - ..
25	Bandberg 4	1200	2000	911	226	2 x 210	3 x 210	3 x 210		1600	2009 - ..
26	Bandberg China	1200	1200 (800)	1440	409	3 x 560	1 x 560			ST 3150/1250	2009 - ..

Maschinenfabrik Hese GmbH | Magdeburger Straße 16a | D - 45881 Gelsenkirchen
phone: +49 (0)209 9 80 99 - 0 | fax: +49 (0)209 9 80 99 - 199 | e-mail: info@hese.de | **www.hese.de**

TTBR1004V01EN