



Controlled Start Transmission



*...total drive control for long
conveyors and multi-drive
synchronized conveyor systems...*



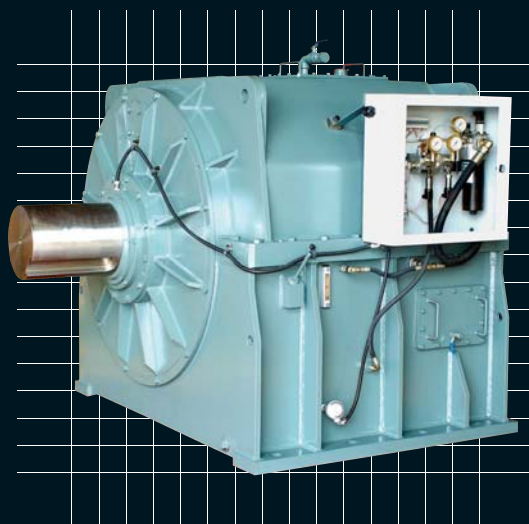
Fort Knox Gold Mine, Alaska - 2km long CST driven conveyor

BALDOR®

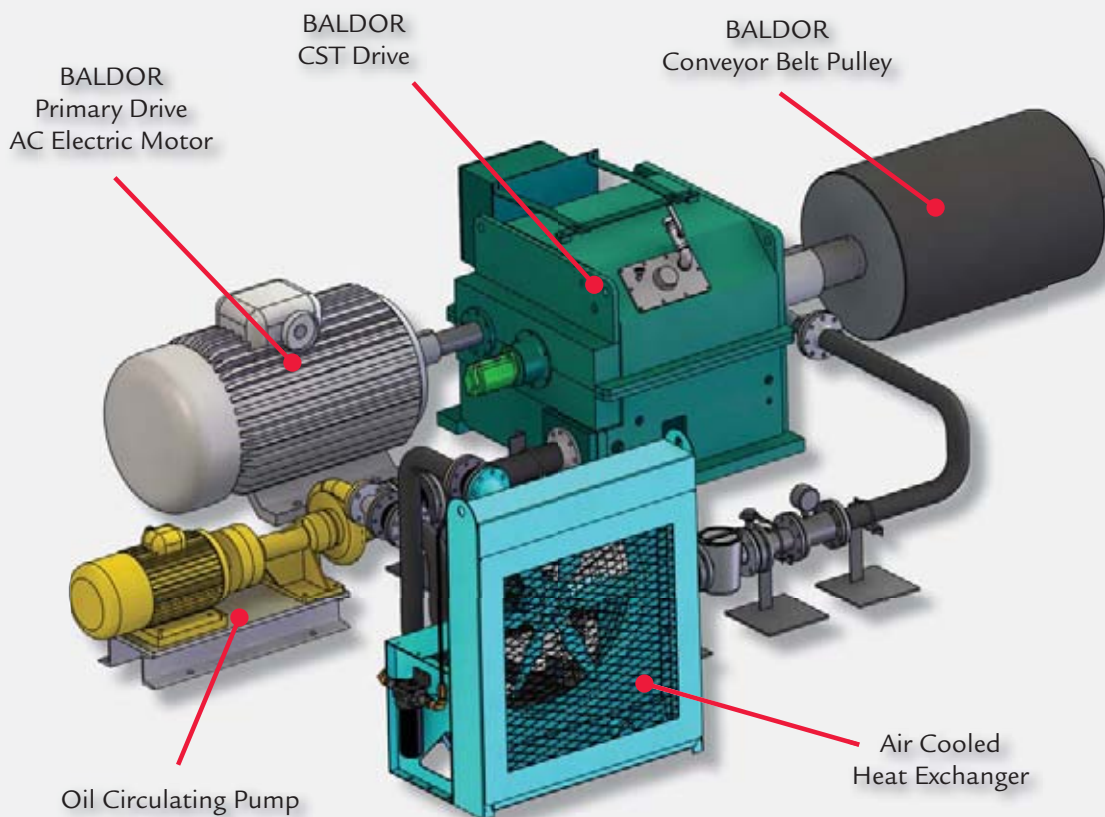
What CST does...

The BALDOR CST (Controlled Start Transmission) is a 2 in 1 drive which combines a planetary gear reducer with an integral hydro-viscous clutch system. When coupled to an AC induction motor, the CST reduction gears convert the motor's high-speed, low-torque input to a low-speed, high-torque output. The integrated hydro-viscous clutch provides smooth, controllable power suitable for direct coupling to a high inertia load, such as a conveyor belt pulley.

The BALDOR CST drive is a very cost effective solution, engineered specifically to deliver total control of the most difficult high inertia loads such as long conveyor belts (1~10kms), and conveyors with multiple synchronized drives. The CST drive provides efficient transmission of motor power and torque with consistent smooth acceleration and deceleration, regardless of varying loads on the conveyor or ambient conditions.



Model CST 1950K/2500K



...a proven solution ...total conveyor control...



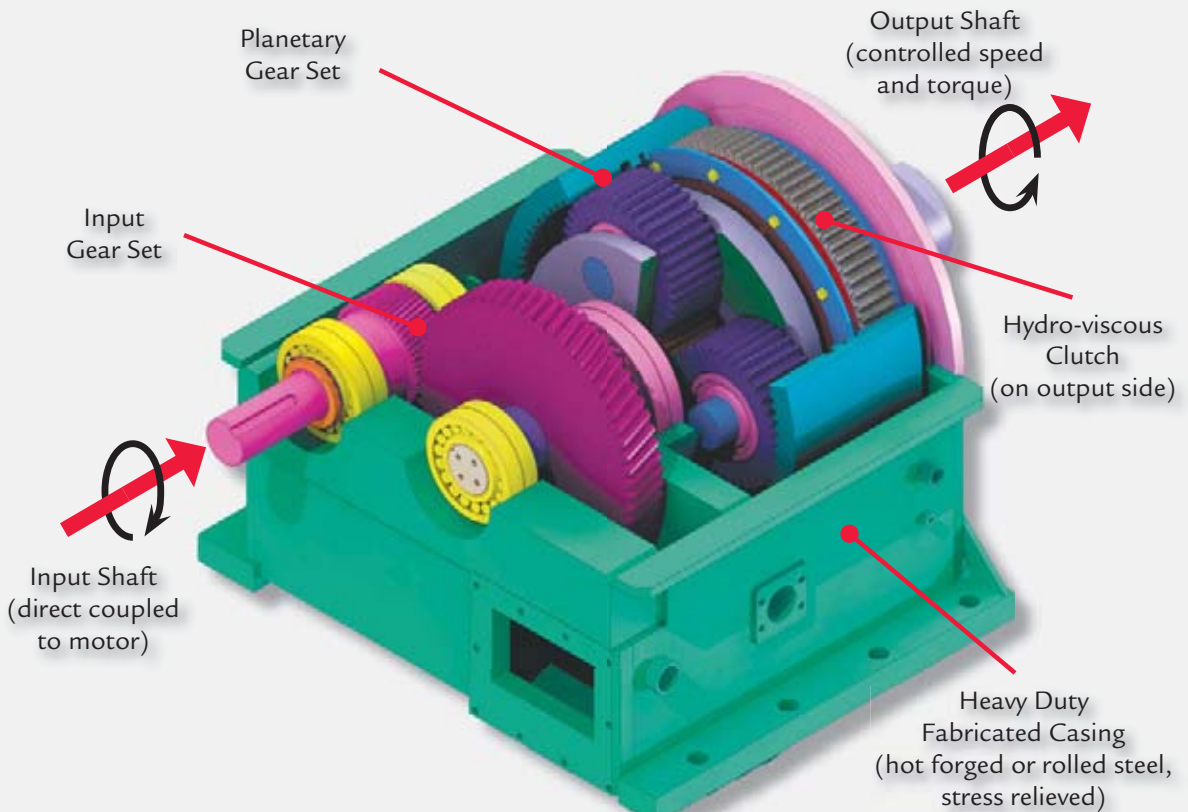
Yulong Cement Plant, China
(8km conveyor with tripper drives)

How CST works...

The BALDOR CST incorporates a hydro-viscous clutch system that is located on the output shaft side of the gearbox, allowing the motor to be started under no-load conditions. The clutch system comprises a set of rotating friction plates and opposing stationary plates, an oil pressure activated piston for engagement, and a spring mechanism for clutch release. Oil is circulated between the plates by a closed circuit pump and cooled through a heat exchanger.

When hydraulic oil pressure is applied to the piston, the clutch plates engage, causing the output shaft to rotate and gradually accelerate to driving speed in a predetermined controlled time.

Drive control and feedback equipment is mounted on the gearcase and comprises a hydraulic manifold, proportional valve, pressure adjusting valve, filters, gauges and sensors. These are interfaced via hard-wiring or data-network with a PLC based CST controller which can control up to four CST units for multi-drive synchronized applications.



...speed reduction ...torque control...

More than soft start...

BALDOR CST delivers a range of benefits not available from electronic soft-start motor control alone.

CST delivers excellent motor load sharing within $\pm 2\%$ to minimize the loads and stresses on all conveyor components. Maximum motor power is available throughout the controlled speed profile, and the clutch unit absorbs shock loads, protects the motor, gearbox, bearings, belt idlers, pulleys, conveyor belts and splices.

The CST control system delivers an S-curve acceleration ramp which further enhances safety, reliability and component protection. Advantages include; a reduction in peak motor torque demand; a reduction in potential slippage between the drive pulley and belt; a reduction in belt tensile stress, shock and surge loads on all non-drive pulleys and structures; a reduction in belt peak stress by up to 15%, resulting in significant potential belt cost savings; and a reduction in take-up travel resulting in improvements in load sharing action, and control of multiple pulley drives.

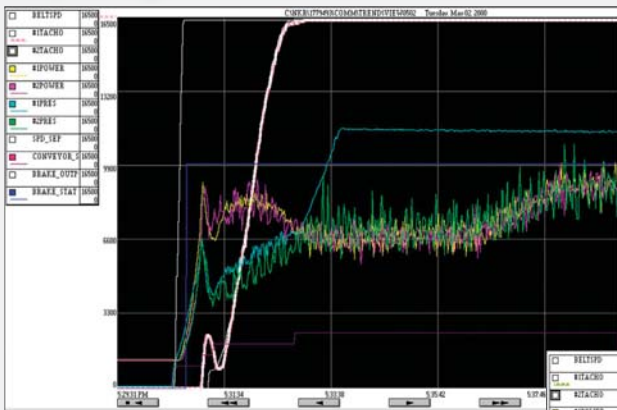


Oaky North Coal Ramp Conveyor, Australia.
19 CSTs above and below ground.

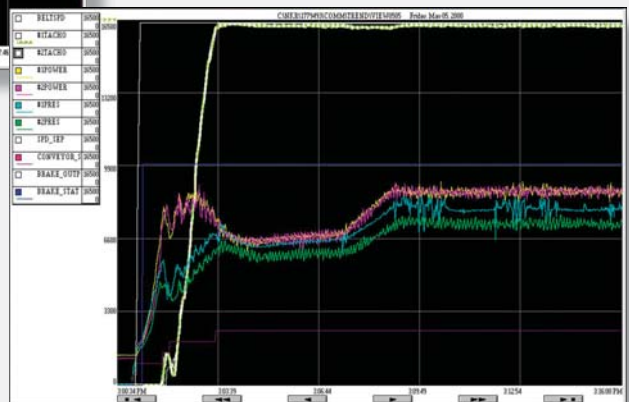


NEMA-4 CST Controller

Trend analysis shows the motor experiencing heavy load surges when the CST clutch is locked.



Trend analysis shows load shocks on the motor substantially smoothed when CST clutch is programmed for soft start. The clutch absorbs shocks and load surges, delivering superior drive performance and overall component reliability.



...controlled acceleration ramp delivers significantly reduced shock loadings and peak stress...



SINOHYDRO Xian Jia Ba Project, China.
(31km, 5 flight conveyor system)

Synchronized control...

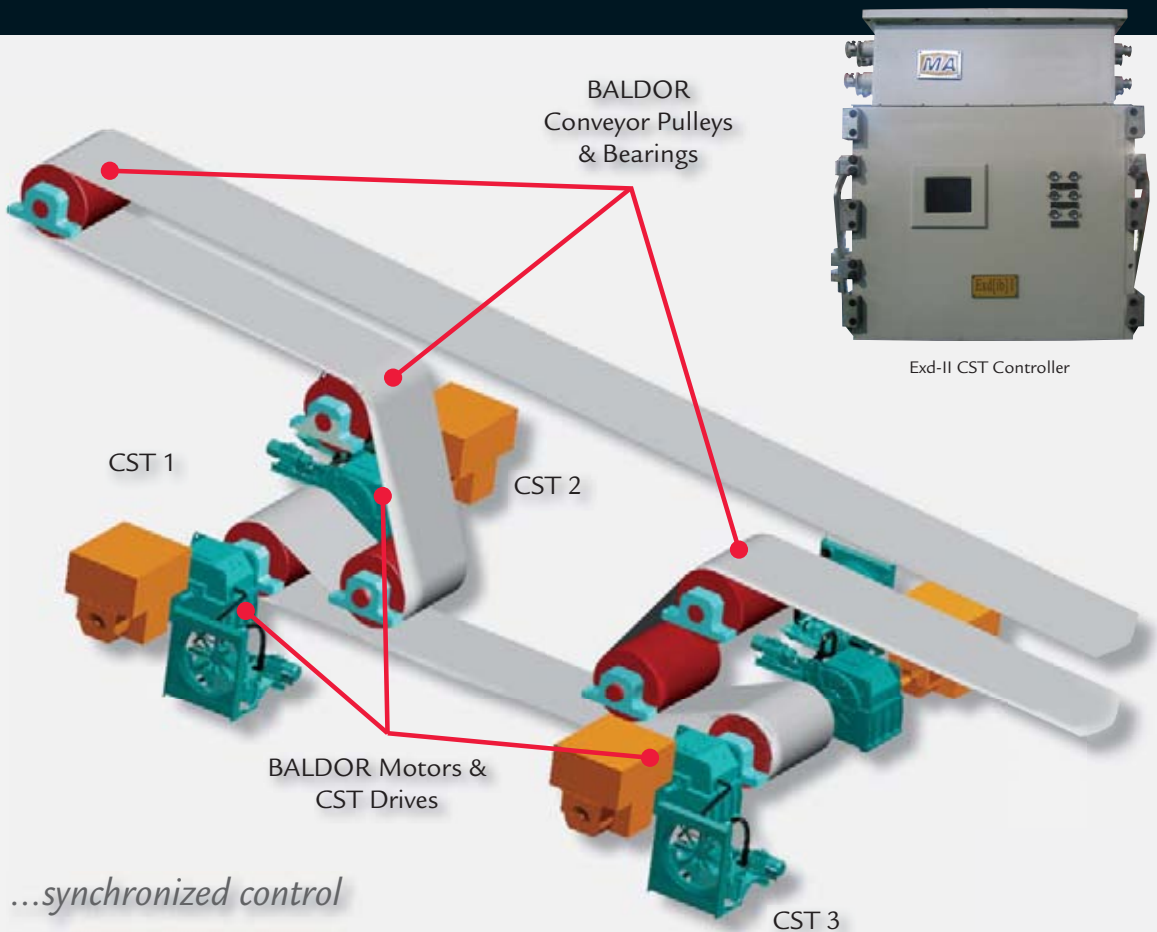
The BALDOR CST control system executes synchronized soft start and load sharing control of up to four CST drives, and can be interfaced with plant remote supervisory systems, interlocks and safety equipment via hard-wiring or over a data-network. The CST controller can be located up to 100m away from the drive.

The CST controller is built on the Allen-Bradley RSLogix and ControlLogix Platform. Standard interface is via DH+ datahighway, while alternative connectivity includes:

→ Profibus → Modbus → Ethernet → DeviceNet

BALDOR CST drives have been proven in head-tail and/or head-tripper-tail synchronized multi-drive configurations in single flight conveyors up to 10km long, and multi-flight conveyors up to 30km long.

All underground CST units and controllers for hazardous areas are engineered to MA/Exd-II and/or local certification requirements.



*...synchronized control
of multiple drives...*

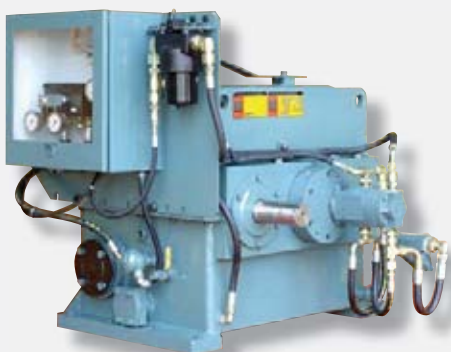
The power of CST...

While the unique clutch design of the BALDOR CST delivers the smooth speed and load control during start-up and shut-down, the precision engineered planetary gear train converts the high-speed, low-torque input from the AC motor, to a low-speed, high-torque output efficiently and safely.

As soon as the motor is up to speed, full torque is available to the clutch. A pre-tension torque is then applied to the belt, up to the point of breakaway (movement of the entire belt). Additional torque is then applied to overcome the inertia requirements of the loaded belt system, as well as the torque needed to accelerate the system to the final running speed. This minimizes system transient forces and belt stretch, yet delivers all the power and torque required to drive the load, irrespective of loading conditions.



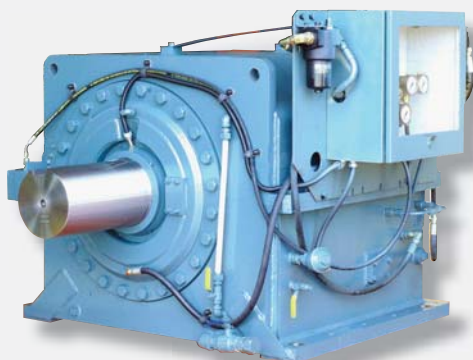
Bontang, Indonesia
(6.5km long coal loading conveyor)



Model CST 280K



Model CST 420KS



Model CST 630K



Model CST 1120K/1500K



Grasree Underground Coal Mine, Australia

The range of CST...

To match the growth in size and complexity of applications, the range of BALDOR CST drives undergoes continuous refinement and development of new and more powerful models. Today there are 9 torque capacities up to 2.5 million inch pounds, in-line and right-angle drive versions, and options for a vertical, close-coupled oil pump to reduce overall unit size, and of course various control options and options for digital interfacing with plant control and monitoring services.

Specific models are also available to suit hazardous environments in overland or underground applications.

BALDOR CST Drive Model Designation

xxxxKyy
 Torque in-lbs
 x1000

R = right-angle drive
 S = safe for hazardous environments
 V = vertical pump mount

Models & Specifications for BALDOR CST Drives

CST Model (K=1000 in-lb Torque)	Max. kW on input shaft @1480rpm (Safety Factor = 1)	Gear Ratio	Output Speed (@1480rpm input) RPM
280K	418	15.3750~38.1563	96.3~38.8
280KR	418	15.2190~57.2128	97.2~25.9
420K	626	16.8636~38.3478	87.8~38.6
420KR	490	16.7334~57.2174	88.4~25.9
H450K	638	17.2941~30.5455	85.6~48.5
630K	940	16.6250~38.3333	89.0~38.6
750K	1147	16.7143~38.5325	88.5~38.4
750KR	876	16.6517~55.5909	88.9~26.6
G750K	1227	15.6214~38.9118	94.7~38.0
1000K	1530	16.7143~38.5325	88.5~38.4
1120K	1566	17.0769~34.9091	86.7~42.4
1120KR	1305	16.8587~57.6261	87.8~25.7
1500K	1827	17.0769~34.9091	86.7~42.4
1950K	2610	17.1000~38.3727	86.5~38.6
2500K	3028	17.1000~38.3727	86.5~38.6

The reliability of CST...

BALDOR CST is not a new invention. In fact many CST drives installed over 20 years ago are still in full operation around the world. This is testament to the performance, strength, simplicity, reliability and serviceability of the material, components and the design. CST clutch life has been proven over-and-over-again to be more than 7 to 10 years and gear life to be over 25 years when operated within specifications.

One of the prime reasons that current clients continually include CST in their expansion plans is often cited as the simplicity of the design resulting in high reliability. But equally as important is the ease of serviceability. Many sites are in very isolated locations, making maintenance the responsibility of on-site engineering teams. No one can afford lengthy shut-downs, and BALDOR CST has a proven track record of average availability >98% and a very low total life cost.



Dexing Copper Mine, China
(6 x 1120K CSTs and Baldor motors)

North America

Clients/locations include:

- Fort Knox Gold Mine, Alaska USA
- Arch Black Thunder
- Consol Energy Jones Fork Mine
- Peabody Energy
- Arch Mingo Logan Coal Co
- Foundation Coal
- Arch Mountain Laurel Mine
- Kennecott Energy
- Cooperative Power Association
- Western Fuels Corp
- Kinder Morgan Shipyard Terminal
- Jewel Smokeless Coal
- Many more not listed here

Mexico

Clients/locations include:

- Comsa
- Mimosa Coal
- Grupo Mexico Copper



...proven track record over more than 25 years...



Thunder Basin Coal Mine, USA
(3 x 2500K CSTs with flywheel
and 2,500HP Baldor motor on skids)

The growth of CST...

Since the first BALDOR CST drives where installed in 1982, their reputation for unparalleled performance and reliability has grown at an ever increasing rate. There are now more than 2,500 CST drives in operation around the world.

China has more than 1600 CST drives in operation on 500 conveyors in 150 locations. In just 2 years from 2005-2007, nearly 400 CSTs were commissioned.

With its huge mining potential, Australia now has more than 228 CST drives in operation, the first of which date back to 1986.

North America also has hundreds of CST units in operation from Alaska to Mexico while there are many more operating around the world

Every year many more bulk handling facilities and mine conveyor systems are being planned with CST units as their prime drive component.



China

Clients/locations include:

- Shen Dong Coal Mine Group
- An Jia Ling Coal Mine Group
- Jin Chen Coal Mine Group
- Lin Wu Coal Mine Group
- Yan zhou Coal Mine Group
- Huai Nan Coal Mine Group
- Dexing Copper Mine
- Yu long Cement Plant
- Xiang Jia Ba Hydro Power Plant Construction Site
- Fu Zhou Sea Port

Asia/India

- Bontang Coal Loading Facility, Indonesia
- Kudremukh Iron Ore Co, India
- Philex High Cement, Philippines

Australia

Clients/locations include:

- Continental Conveyors (OEM)
- Nepean Conveyors (OEM)
- Anglo Coal, QLD
- BHP Billiton Mitsubishi Alliance, QLD
- Bowen Basin, QLD
- Hunter Valley, Lithgow, Mudgee and Illawarra, NSW

...more than 2500 CSTs in operation around the world...

The CST package...

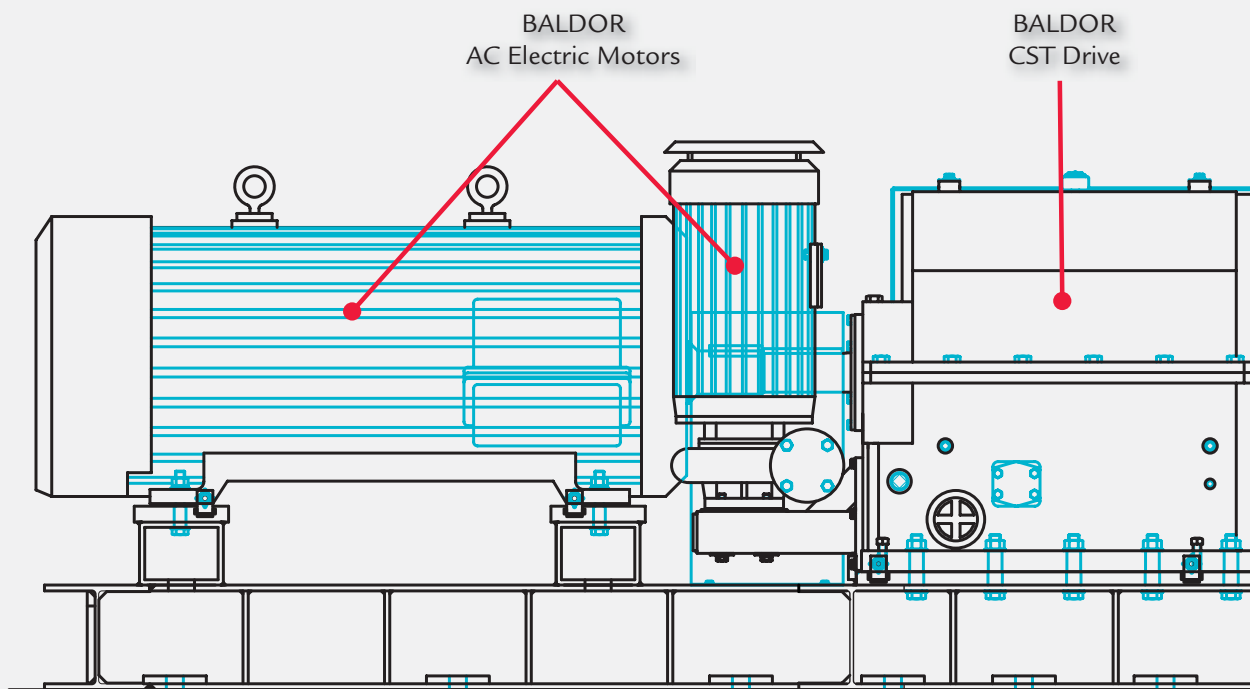
Conveyor drive analysis and design is a specialised field requiring specialist knowledge, software, equipment, products and experience. Today, many clients prefer to purchase a complete packaged solution which has a proven track record and can meet specific lead-time requirements.

BALDOR has all of the above at its fingertips, and can provide a comprehensive packaged solution to meet any application in any location.

BALDOR is the largest motor manufacturer in the USA, and an industry leader in the design and manufacture of high efficiency AC and DC motors with ratings up to 12,000kW. The truly comprehensive range of BALDOR power transmission products is highly respected around the world, and has been serving industry for nearly 125 years. These products include gear units, conveyor belt pulleys, couplings, drive pulleys and bearings.



An Jia Ling Coal Mine, China



...total package...

Service & Support...

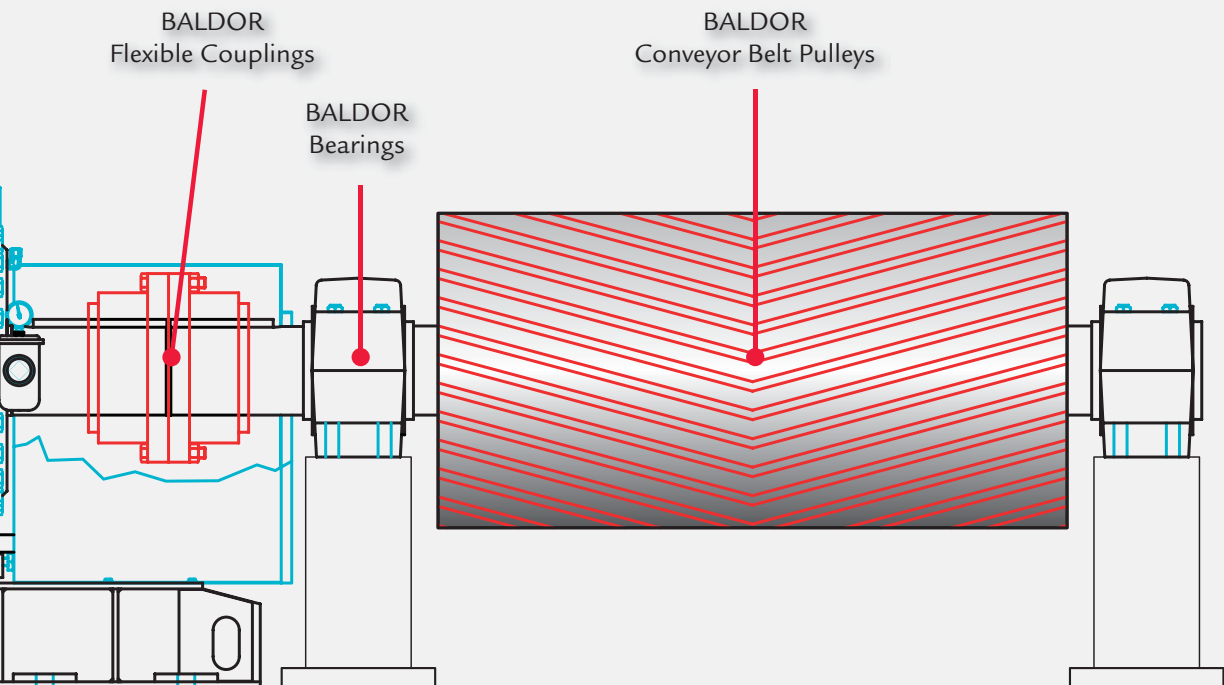
BALDOR operates sales and support centres on every continent ensuring rapid access to parts and support.

Although many CST operators prefer to manage their own maintenance and engineering needs, some clients prefer to out-source these tasks. Due to the high density of CST units throughout China, a Professional Maintenance Package is available, and has proven very successful at the Shen Hua Shendong Mines where more than 300 CST are in contract.

The package can be tailored to individual requirements, and is designed to ensure conveyor drive availability above 98%. Packages can include: routine and preventive maintenance of all CSTs; daily, monthly and six-month maintenance schedules; 5-7 year rebuild schedules; 12-year equipment warranty after rebuild; dedicated manpower for emergency breakdowns; on-site parts and service for minor repairs; remote monitoring and diagnostics.



Shendong Mines, on-site contract maintenance



...total support...

CST production...

Since 1982, the BALDOR CST has been manufactured in modern factories in North America. In 2000 a CST and motor service plant was established in China. To meet the ever increasing demand for BALDOR CST systems and other BALDOR power transmission products throughout Asia and the Pacific, and to ensure quality production within reliable delivery schedules, a new 30,000m² BALDOR plant was opened in 2008 in Shanghai, China.

Over 100 highly trained and experienced engineering and manufacturing staff make up the BALDOR production and support teams within China. There are also many experienced BALDOR sales and engineering staff strategically located throughout the world to provide local CST knowledge and support, ensuring continued expansion of our client base, and total satisfaction with every BALDOR CST drive in operation.



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Shanghai, China

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**Controlled
Start
Transmission**

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This material is not intended to provide operational instructions.

Appropriate instruction manuals and precautions should be studied prior to installation, operation or maintenance of equipment.

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