

MEDIUM VOLTAGE SOFT STARTER APPLICATIONS

A Comprehensive Experience
Reference List

ON

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Medium Voltage Soft Starter Application Solutions

A Comprehensive Experience Reference List

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Soft Starters for the Supply Ships

Driving retractable thrusters
Motor ratings: 6600V, 4500KW



HRVS-DN 6600V, 4.5MW



The Blue Marlin

The Blue Marlin, refurbished by HHI (Hyundai Heavy Industries), was designed to carry heavy loads such as drilling rigs and other static floating objects.

The ship is equipped with 3 generators, rated at 3655KW, 6600V, 400A and 2 retractable thrusters rated at 4500KW, 6600V, 486A. The high power rating of the thrusters in relation to the three generators required that special attention be paid to starting-current and voltage-drop issues.

Some of the critical requirements were:

- a. Limiting the starting current and the voltage drop to acceptable levels.
- b. Ability to start the thrusters with only two of the three generators running.

After comparing the various available starting methods available (including auto-transformer starter, electronic soft starters and variable frequency drives) it was decided that a Solcon HRVS-DN medium voltage soft starter would offer the optimum solution both technically and financially.

Two HRVS-DN soft starters were installed. Starting current is 360% of I_n and starting time is 12 sec. Voltage drop when starting the thruster with only two generators running is less than 5%. The application was a huge success.

Soft Starters for Main Propulsion in “BC Ferries” C-Class

Driving main propulsion

Motor ratings: 1200A/11MW/6600V



Passenger ferries spend a lot of time maneuvering at dock while at the same time, trying to ensure passenger comfort. Soft starters for main-propulsion eliminate the initial torque surge on the shaft as the enormous propeller begins to turn. It also eliminates the voltage drop associated with starting these large motors (minimizing the generating capacity required) and reduces wear and tear on the mechanical system.

When designing BC Ferries latest C-Class, the designers were looking for a highly dependable soft starting systems for the main propulsion system - one that would endure continuous performance under some of the most adverse conditions including constant vibration, temperature variations and corrosive ambient conditions.

Solcon's HRVS-DN was chosen for its proven track record in these types of marine applications.



Passenger Vessel - BC Ferries C-Class Design
Project Contractor - Flensburger Schiffbau, Germany
Integrator - SAM Germany
Motor type - 6 x 11MW at 6.6KV, Main propulsion, 2 per Ferry

Soft Starters for the On-shore Liquid Gas Industry

Driving Liquid Gas Pump
Motor ratings: 4160V, 110A
Edson Gas Plant, Alberta, Canada



In order to transport gas through a pipeline, it must first be liquefied.

At the Edson Gas Plant, the gas is pumped from underground, re-liquefied and then transported via underground pipes to a distribution station. Due to the harsh environmental conditions (nightly temperatures at the Edson plant easily reach -40°C between November and March), the consulting engineer prescribed the use of soft starters. Since Solcon HRVS-DN soft starters are known for being able to operate in some of the most difficult environments, Solcon was selected for the job.

These soft starters, rated at 900 HP, reduce high inrush current on starting and eliminate problematic system wide voltage drops while the motor comes up to full speed. Solcons state of the art digital technology keeps operators aware of the motor and soft starter operating status while the built in protection package ensures safe operating boundaries even under changing ambient conditions.



Liquid Gas Pump
MV Soft Starter HRVS-DN 4160V-110A

Soft Starters for the Offshore Oil & Gas Industry

Driving seawater injection pumps,
gas compressors, etc.

Motor ratings: 6600V - 11000V, 80-400A
FPSO - Berge Helene

Berge Helene - converted to an
FPSO at Keppel shipyard



The Chinguetti oil field (located off the west coast of Mauritania) is being developed by the converted tanker ship Berge Helene (owner: Bergessen Offshore).

The gas compressors, seawater injection pumps, hot oil and emergency fire pumps are started by Solcon HRVS-DN medium voltage soft starters. These soft starters provide successful motor starting while eliminating high inrush current and damaging torque surge on start up.

- 3 x 11kV 400A gas injection compressors
- 2 x 11kV 300A water injection pumps
- 1 x 6.6 kV 80A hot oil pumps
- 1 x 6.6kV 80A emergency fire pump

The motor protection package built in to each HRVS-DN starter provides comprehensive motor and starter protection for long term operation and system reliability.



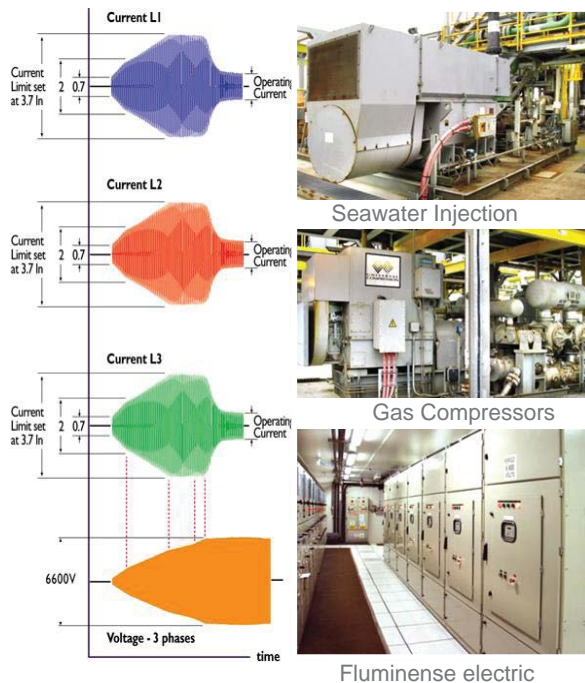
Solcon's HRVS-DN 11KV

Soft Starters for the Offshore Oil & Gas Industry

Driving seawater injection pumps, gas compressors, etc.
 Motor ratings: 6600V, 400A
 FPSO - Fluminense



FPSO Fluminense - operated by Shell



The FPSO Fluminense is developing the Bijupira oil field off the coast of Brazil. The engineers who were responsible for supplying the motors for the pumps knew to call on Solcon for their vast experience in marine duty applications.

This application requires artificial lift to raise the reservoir fluids and gas to the surface for processing. Reservoir pressure is maintained by the high pressure injection of seawater using heavy duty MV motor driven pumps.

The requirement is to soft start seven 6.6KV motors with the goal to eliminate the high inrush electric current so it would not interfere with the FPSO electrical system. The soft starters also eliminated the damaging mechanical torque that would otherwise jar the motor shaft on every start.

Electrical contracting by Siemens

7 Medium voltage soft starters:

- 3 x 6.6KV, 400A Soft starters for gas injection compressors
- 3 x 6.6KV, 400A Soft starters for seawater injection pumps
- 1 x 6.6KV, 400A Soft starter for emergency fire pump

Soft Starters for the Oil & Gas Industry

Driving centrifugal booster gas compressors

Motor ratings: 11000V, 232A, 3.8MW
Mumbai South Platform, India



HRVS-DN, 11KV/300A

160Km off the coast of Bombay, the Oil & Natural Gas Corporation of India is developing the Mumbai oil field. Engineers designing the project designed in Solcon HRVS-DN soft starter on the four 11KV 3.8MW motors powering centrifugal booster gas compressors. The motors drive the compressors through a gear unit allowing the compressors to turn at 9300 RPM. Solcon soft starters eliminate the high mechanical starting torque that would otherwise jar the motor shaft and gear unit. They also eliminate the high inrush electric current that with a DOL start, would interfere with the electrical distribution system.

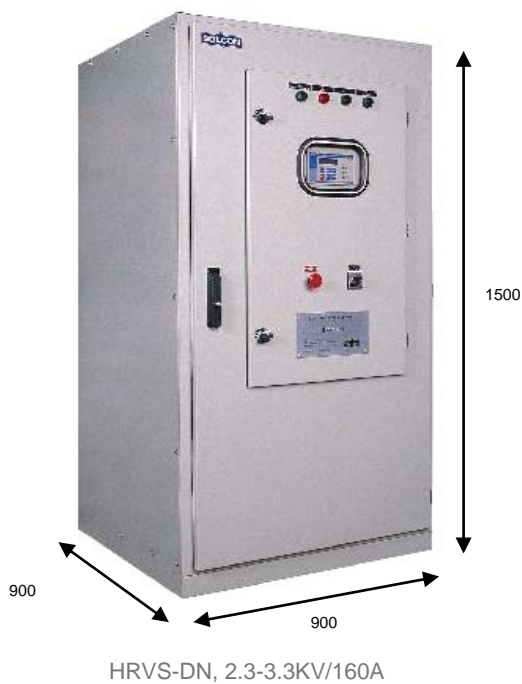


Motor: TEMIC (Toshiba & Mitsubishi) 11,000V, 232A, 3.8MW, 1480RPM, 50Hz
Load: Centrifugal Booster Gas Compressor driven by 6:1 gear unit. Compressor speed is 9300RPM

Soft Starters for the Oil & Gas Industry

Driving crude oil pumps

Motor ratings: 2300-3300V, 160A
North Sea, UNOCAL Helder-A Platform
The Netherlands



Off the coast of The Netherlands, in the cold water of the North Sea, "UNOCAL 76" is pumping crude oil via nine MV pumps. Six of these are equipped with HRVS-DN mini height soft starters.

The design goal was to save the overworked pumps from excessive torque surges. The ideal solution for these sea bed pumps located 900 meters below sea level was Solcon HRVS-DN soft starters. The first was installed and operated in 1997 and the final one was installed in 2005.

Solcon soft starters eliminated the high mechanical torque surge and prevented damage to the motor shaft.

This unique application required a special design to fit into a 1.5 meter high space - this was done at Siemens's request with the last one being shipped within an amazing delivery time of only 5 days!



Helder A "Platform North Sea" six units are installed and operating
Customer: UNOCAL 76 (United Oil of California)
Special requirements: Dual voltage at 2.3 & 3.3KV and Max. cabinet height - 1.5 meter
Unsurpassed delivery time: 5 days

Soft Starters for the Offshore Oil & Gas Industry

Driving water injection pumps

Motor ratings: 6600V, 1.8MW
FPSO - Petrojarl1



Solcon's HRVS-DN, 6.6KV

The Glitne oil field, in the Norwegian section of the North Sea, is being developed by the Floating Production Storing and Offloading (FPSO) vessel designed by Golar Nor and built by NKK shipyards (owner: Statoil).

The water injection pump is soft started using a Solcon HRVS-DN. Utilizing a current limiting starting curve at 1.8MW/6600V, the soft starter eliminates high current inrush and the resulting voltage drop while starting the pump.

The enhanced motor protection package built into each HRVS-DN soft starter provides alarm and trip features that insure against potential motor and pump damage. Features include shear-pin protection, under voltage protection, ground fault protection and a variety of other selectable and adjustable protective features.

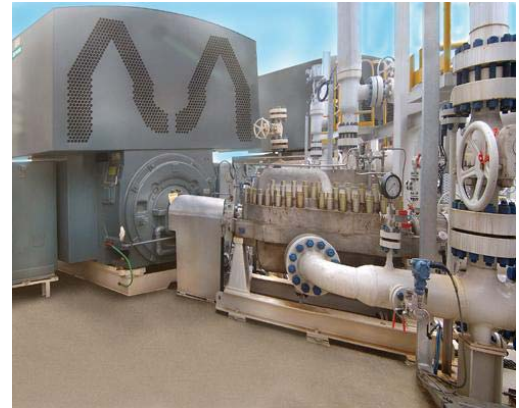


Petrojarl I-FPSO designed by Golar Nor, built at NKK Shipyard

Soft Starters for the Oil & Gas Industry

Driving seawater injection pumps

Motor ratings: 11000V, 118A
FPSO - Santos, Australia



Siemens Motor 11KV, 118A,
2600HP 3577 RPM
Driving a water injection pump

Extruding crude oil from under the ocean floor requires the pumping of vast amounts of seawater into the cavity under the ocean floor in order to create pressure to force the crude out and up toward the ocean's surface.

Thousands of horsepower are used for this type of application. The seawater injection pump is powered by a Siemens 11kV, 118A, 2600HP motor. Solcon was called upon for their expertise in producing highly reliable soft starters that would provide smooth, stepless acceleration while eliminating high inrush currents and damaging torque surges during start up.

With the added benefit of the built in motor protection package, long term operation and reliability is possible even in the most demanding applications like this one.

Santos Modec Venture 11 in the
Mutineer Exeteeer field



Solcon's HRVS-DN, 11KV
With an MPR-6/DGF

Soft Starters for the Offshore Oil & Gas Industry

Driving water injection pumps

Motor ratings: 11,000V, 300A

FPSO - PGS-Petrojarl II Foinhaven



Solcon's HRVS-DN, 11KV, 4.5MW

After years of successful operation of HRVS-DN soft starters on the vessel Pertojarl I, a new sister ship - the PGS Foinhaven is now in service. This FPSO is equipped with the HRVS-DN soft starter to drive the water injection pumps used to re-inject crude laden produced water into the reservoir and minimizes the environmental impact of the pumping process.

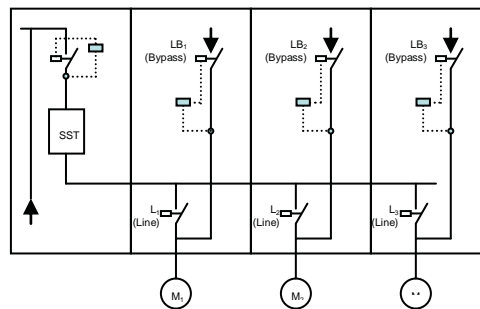
The produced water injection pump is soft started by the HRVS-DN using a current limit starting curve at 300A/11000V. The soft starter eliminates high current inrush and consequential voltage drop allowing for ship-wide voltage stability while starting the pump.



Petrojarl II-Foinhaven-PGS-FPSO equipped with 11KV/4.5MW HRVS-DN soft starter.

Soft Starters for the LNG Industry

Driving 8 cargo pumps and 2 chiller compressors
 Motor ratings: 6600V, Multi-motor ratings
 LNG - Northwest Swan



Solcon's HRVS-DN 6.6KV in a multi-start configuration

Years of successful operation on board LNG carriers convinced Samsung Heavy industries to continue using Solcon HRVS-DN multi start soft starter design in their newest applications on the vessel - Northwest Swan.

Cargo pumps circulate liquid natural gas at -170°C. When starting, the initial friction at such temperatures causes difficult starting conditions. The four cargo pumps are soft started by the HRVS-DN, thus eliminating high inrush current and torque surge that could potentially damage these very expensive and critical pump motors.

Utilizing a dual-adjust curve, the chiller compressor uses the soft starters same current limit curve to eliminate high inrush current and the resulting voltage drop for ship-wide voltage stability.

The motor protection package built into the HRVS-DN ensures protection from any number of potential fault conditions for each of the motors in this unique "multi-start" system.



Northwest Swan equipped with 2x6.6 KV HRVS-DN soft starter in a redundant multi-start configuration

Soft Starters for the Power & Utility Industry

Driving water pumps

Motor ratings: 4160V, 800A, 5MW
Empresa Generadora de
Electricidad Haina SA



In the Dominican Republic, the power utility expansion was inevitable. The consulting engineers were looking for a heavy duty solution that would be suitable for operation in humid and salty air conditions with temperatures as high as 50°C. They also wanted the latest pump control features. The ultimate solution was Solcon's HRVS-DN, high-end medium voltage soft starter.

The HRVS-DN's pump-control software eliminates the damaging effect of water hammer. Water pipes, joints, check valves and other components are protected from mechanical shock while the built-in motor protection relay provides comprehensive protection to both the motor and the soft starter.



5MW at 4160 (800A) x 2HRVS-DN
for water pumps at
Electricidad Haina SA, Santo Domingo

Soft Starters for Water Desalination

Driving water pumps

Motor ratings: 6600V, 400A
Desalination Plant, Ashkelon



HRVS-DN 6600V / 400 A
for 6 desalination pumps

This new desalination plant has six enormous pumps (over 3 MW each) driving high pressure sea-water through its filtering system on its route to being drinking water.

The soft-starting process must be smooth and stepless due to the sensitive piping system involved in desalinating water.

Solcon's HRVS-DN medium voltage digital soft-starter provides smooth and stepless acceleration and deceleration characteristics, eliminating excessive starting torque, pressure surges and water hammer effects which can damage the piping system.

Soft Starters for the Water Industry

Driving water pumps

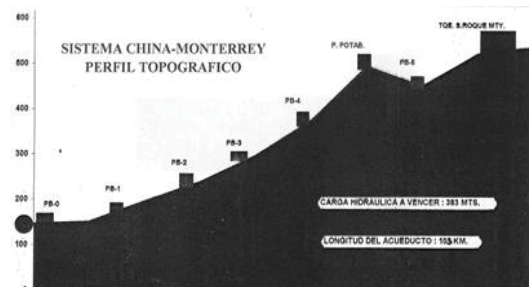
Motor ratings: 4160V, 400A
Monterrey, PBO pumping station
Mexico

The City of Monterrey is situated 2000 meters above sea level. Supplying water to the city requires many booster pumps operating periodically to keep the water pressure at a suitable level. It was very important to eliminate the high inrush current and start-up torque on every start and to have the ability to soft-stop these pumps to eliminate damaging water hammer that threatens the pipe joints, valves, and instruments with every stop.

Solcon soft starters not only soft start and soft stop, but also provide start and stop pump curves that increase the life of both the pumps and the piping infrastructure. The built in motor protection system and the additional motor protection relay provides comprehensive protection to both the motor and the soft starter.



4 x 4.16KV, 400A



Soft Starters for the Water Industry

Driving Water Pumps

Motor ratings: 3300V, 400A
Mekorot Water Company, Israel



5 Soft Starters 3300V,
1250 & 1500HP



Medium Voltage soft starter for 3.3 KV
at 400A. Five units are installed in the
Rosh-Pina pumping station.

The city of Rosh Pina depends on subterranean aquifers for fresh water. Raising water from these aquifers deep below the earth's surface requires the use of massive pumps driven by medium voltage motors totaling thousands of horse-power.

Solcon HRVS-DN soft starters with their unique pump starting curves eliminated the high inrush current that would otherwise disrupt the power grid. They also eliminated the high starting torque that would shorten the life expectancy of pipes, valves and fittings.

The destructive effect of water hammer is virtually eliminated when using Solcon's specialized pump control stop curves, ensuring lower maintenance cost and downtime. The built in intelligent motor protection package provides enhanced supervision for both the motor and the soft starter, further extending the useful life of the system.

Soft Starters for the the Pump Industry

Driving Water Separation Pumps

Motor ratings: 4160V, 200A
New Mexico USA



4.16kV, 200A in NEMA3R
"Outdoor" Enclosure



Desert temperatures provide the extreme...not just high daytime temperatures but in low night-time temps, sand storms and more. These conditions call for extreme measures in the form of a 'true' NEMA3R 'door-in-door' outdoor rated cabinet. In addition to this unique cabinet design, the Solcon MV Soft Starters come standard with conformal coated PC boards and special hardware to protect against corrosion, dust and other environmental challenges.

These Solcon MV SSRV units are used in a water separation process and to recharge the aquifer. They have been in use since 2011 and continue to operate flawlessly in some of the most challenging outdoor conditions you can find in the state of New Mexico.

Soft Starters for the Copper Mining Industry

Driving booster pumps in mining

Motor ratings: 4160V, 450HP

A copper mine in Arizona



4 x 4.16kV, 110A MV soft starter line
up with transformer and PLC cabinet



Solcon USA provided an 11'x35' E-house complete with (4) 450hp, 4160V MV solid state starters, (1) transformer cabinet for local power, a PLC cabinet and touch screen HMI. Included dual platforms for a booster pump station for a copper mine in Arizona.



Turn-key E-house

The entire package was built and shipped to the site in less than 16 weeks and is fully installed, commissioned and operational.

Soft Starters for the Mining Industry

Driving Critical Ventilation Fans

Motor ratings: 6600V, 1MW
Kahama Gold Mine, Tanzania



Mobile electric room for exhaust fans

With nearly 1000 employees, the Kahama Gold Mine is considered to be Tanzania's largest underground mining investment. Solcon's HRVS-DN medium voltage soft starters were specified for controlling the fresh air ventilation fans in this massive underground mining venture.

Starting these four 1MW fans with a 6.6KV, 300A soft-starter not only eliminates the high inrush current that disrupts the power grid on every direct-on-line start, but it also allows for constant monitoring of the fan's "vital signs" for preventative maintenance purposes. This is accomplished via the advanced motor protection system in the HRVS-DN soft starter.



"All in One" version, including:

- Main Switch
- Fuses
- Motor Protection Relay and Digital Power Meter

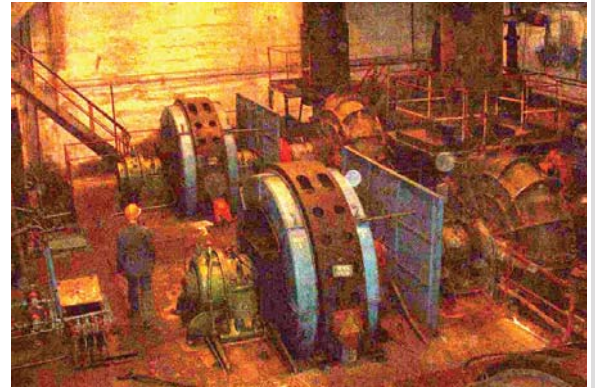


One of the 3m diameter mine exhaust fans

Soft Starters for the Mining Applications

Driving 4 Synchronous Motors

Motor ratings: 6600V, 600A
Noriilsk, Russia



4 motors at 6600V / 600A



One Multi-Start Solcon HRVS-DN starting 4 synchronous motors at 6600V/600A - Cost effective with low spatial overhead

The Solcon HRVS-DN soft starter with its multi-start, starting capabilities proved to be the ideal solution for this application. The HRVS-DN line-up is built in a Multi-Start arrangement, starting each of the 4 synchronous motors sequentially.

One soft starter for four motors saves precious space, engineering, construction and installation costs.

Solcon is known for their ability to provide unique, cost-effective solutions in difficult applications.

Soft Starters for the Diamond Mining Industry

Driving a conveyor

Catoca Diamond mining plant
Motor ratings: 6600V, 140A
Catoca, Angola

Because the plant is situated in a very remote location, voltage drop due to high motor inrush current during starting created problems at this facility. Diamond plant engineers in Angola contacted Solcon to help them reduce the current inrush while soft starting their main conveyors.

Solcon HRVS-DN medium voltage soft starters offer adjustable starting curves that eliminated the high inrush current that would disrupt the already unstable power grid. By using a soft starter they also reduced the high starting torque, eliminated the potential for damage to the conveyor belt and extended the life expectancy of the conveyor mechanical system.

The built in intelligent motor protection package provides enhanced supervision for both the motor and soft starter, further extending the life expectancy of the system.



6600V, 140A
Soft starters



Mining conveyor at the Catoca Diamond Plant - The fourth largest diamond mining plant in the world. Motor size: 140A at 6600V

Soft Starters for the Fertilizer Industry

Driving blowers in a fertilizer plant
Motor ratings: 6600V, 250A
Queensland, Australia



Scrubber blower in the Incitec Pivot fertilizer plant in Queensland, Australia. Motor size: 250A at 6600V



Soft Starters 6600V,
250A Blower Fan

When Incitec Pivot expanded their Queensland plant, they contacted Uniserve for a recommended solution for starting their major blower fan. The motor inrush current had to be limited because the factory could not sustain the voltage drop caused by the high inrush when starting direct on line.

A Solcon HRVS-DN soft starter with its adjustable starting curves eliminated the high inrush current that was disrupting the power grid. It also eliminated the high starting torque that could have caused damage to the motor/blower shaft. By eliminating this wear and tear on the system, Solcon was able to increase the life expectancy of the entire system.

The built in intelligent motor protection package provides enhanced supervision for both the motor and soft starter, further improving the life expectancy of the system.

Soft Starters for the Fertilizer and Chemical Industries

Driving Fan

Motor ratings: 3300V, 80A
Rotem Fertilizer Plant - Rotem Plateau

This industrial blower, drawing 1MW of power, keeps the process furnace hot. The fan was initially designed with a damper over the intake for start up. Starting the fan without a damper caused a very high inrush current at 3.3KV.

Over time, the damper malfunctioned and was no longer serviceable. When this happened, the starting inrush current became so high that one of the motor's rotor bars would crack every few months.

The customer installed a Solcon HRVS-DN soft starter at a fraction of cost to repair the damper repair and the associated downtime. The soft starter not only eliminated need for the damper but it eliminated the high inrush current and provided benefits to the mechanical system by eliminating mechanical shock.

Over 10 years have passed since this HRVS-DN soft starter was installed and since then, the system has been operating flawlessly.

The built in motor protection system provides additional assurance of early detection of any changes in the system, allowing for pre-emptive maintenance to avoid any future motor damage.



Industrial Blower:
3.3 KV, 80A, 1MW



MV Soft Starter
HRVS-DN 3300 V, 80A

Soft Starters for the Steel Industry

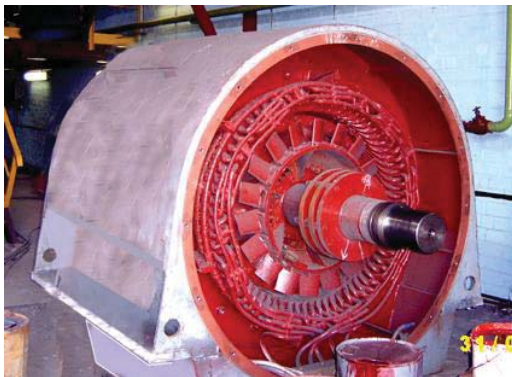
3 Fan Multi-start

Motor ratings: 10KV, 167A
Severstahl Steel Factory, Russia



MV Soft Starter
HRVS-DN 10KV-240A

Ventilation fans are vital to the operation of a steel factory. For an application this critical, engineers rely on the long term reliability and high standards of Solcon. The Solcon HRVS-DN soft starter configured for a multi-start application was the ideal solution for this application. One soft starter for three motors (starting each of the three synchronous motors sequentially) saves precious space, engineering, construction and installation costs.



Motor: Synchronous, 1000 RPM,
10KV, 167A, 2500KW



Ventilation fans of the Severstahl Steel factory in Russia, powered by 3 motors soft started by one Solcon Multi-start HRVS-DN soft starter

Soft Starters for Chiller Applications

Driving Trane air conditioning chiller

Motor ratings: 3.3KV, 800KW

Nillit-nylon yarn, Israel

HVAC chillers require as much as 20 seconds before the motor attains full operating speed and nominal current. During this time, current draw can be 6 times the nominal current

Nillit, a factory producing the world's tinniest nylon yarn requires massive cooling capacity. For this purpose, three medium voltage 800KW Trane chillers were installed. Solcon soft starters were chosen to start these motors because they eliminate the high inrush current so that there is no detrimental voltage drop felt in the factory.

Solcon's state of the art digital technology keeps operators aware of motor and soft starter operating status, ensuring long term reliability and nearly maintenance free operation.



Solcon's HRVS-DN, 3.3KV, 150A



Solcon soft starts 3 of these CVHE-W-8A 800KW
Trane chillers

Soft Starters for Gas Compressor Applications

Driving liquid gas compressors
Motor ratings: 6KV, 900-1250KW
Petro China - Oil pumping facility



HRVS-DN 6K



In order to transport gas through a pipeline, the gas must first be liquefied in a process similar to that used by air conditioning compressors.

The Changqing Oil Pipeline Company liquefies the gas at the HuiAnPu oil transportation station using four Medium Voltage compressors soft started by Solcon HRVS-DN soft starters.

These soft starters, rated for 900-1250KW, reduce high inrush current on starting that had otherwise, created system wide voltage drops (on an already challenged utility) while the motors were coming up to speed.

Solcon's state of the art digital technology provides operators with the status of the equipment for preventative maintenance purposes.



4 Liquid Gas Compressors
2 x 1250KW, 6.0KV, 3000RPM
1 x 1000KW, 6.0KV, 3000RPM
1 x 900KW, 6.0KV, 3000RPM

Soft Starters for the Oil & Gas Industry

Driving Booster Pumps

Motor ratings: 4160V, 800A
Enbridge Pipelines, Fort McMurray
Alberta, Canada



Gasification, 5000HP
HRVS-DN 4160V / 800A

At the Fort McMurray pump station installation, inrush current while starting the 2 new pumps was a potential problem. Enbridge engineers searched for a solution that would eliminate the high inrush current when starting and eliminate related voltage drop issue.

The equipment also had to operate in severe environmental conditions allowing for long term, dependable operation and reliability.

Soft Starters for the Material Handling Applications

Driving material handlers

Motor ratings: 4160V, 110A
Coal un-loader at Alabama Power Plant
Jasper, Alabama



Finland's Mantsinen Group has developed a new generation of electrically powered cranes to meet the demands of increasingly environmentally-aware customers. Solcon's HRVS-DN medium voltage soft starter allows them to start the electrically powered hydraulic coal-unloader more effectively and efficiently while eliminating the cost of diesel generator fuel and maintenance.



Mantsinen coal un-loader now uses a 4160V / 110A HRVS-DN with MPS3000 motor protection relay



SOLCON

WATER

OIL & GAS

INDUSTRY

MINING

MARINE



Soft Starters ■ Motor Protection ■ Power Controllers

T: +1 724.473.1301 | F: +1 724.473.9506 | E: sales@solconusa.com | W: www.solconusa.com

2528 Lovi Road, Building 2-2A, Freedom, Pennsylvania 15042 USA