

China's Largest Refinery

Dushanzi Refinery, Xinjiang, China



The new Dushanzi Refinery in Xinjiang, China, houses 20 refining process units and 12 petrochemical processing units.

The Dushanzi Refinery in Xinjiang, China, is part of The National Development and Reform Commission's execution plan to process 82 million metric tonnes (90 million tons) of new oil in China by 2010. With an approximate investment of US\$4 billion, it will make Dushanzi Refinery the largest refinery in China. The plant will refine oil from the Kazakhstan–China crude oil pipeline. Once the plant is put into operation in August, 2009, it will have the capability to process 9.1 million metric tonnes (10 million tons) of crude oil in a year and 1.1 million metric tonnes (1.2 million tons) of ethylene a year, in addition to other valuable chemicals¹. The Dushanzi Refinery utilizes the largest engine/compressor train in the world.

Dushanzi Requires Reliability

China is relying on Dushanzi to supply the country with massive amounts of oil, ethylene, and other chemicals. It is vital that the refinery have continuous and uninterrupted production, while at the same time providing a safe working environment for the employees. Shutdowns are extremely expensive, leading to increased production and maintenance costs.

Dushanzi Chooses Woodward

Woodward was selected as the control of choice for all three of Dushanzi's new critical compressor trains (cracked gas, ethylene, and propylene) due to Woodward's highly reliable control platforms, advanced compressor protection algorithms, and ability to control very difficult ITCC applications. The Woodward MicroNet TMR[®] control platform meets all of Dushanzi's, Linde's, and Siemens' stringent system control, protection, and plant interface requirements. Woodward's IEC61508 certified system, competitive price, outstanding reputation, and friendly relationship with Siemens were additional reasons given by Dushanzi representatives for choosing Woodward equipment for this project.

Type of Plant

Ethylene & Propylene Refinery

Location

Xinjiang, China

Applications

1. Cracked Gas Compressor
2. Ethylene Compressor
3. Propylene Compressor

Turbine Sizes

1. 56612 kW, Single Extraction
2. 33510 kW, Single Extraction
3. 22467 kW, Single Extraction

Compressor Sizes

1. 5 stages + 2 ASVs
2. 5 stages + 5 ASVs
3. 3 stages + 3 ASVs

Woodward Equipment per Application

- MicroNet TMR[®] System
- Citect HMI
- Entire Cabinet
- 5009C Software

¹"Dushanzi Integrated Refinery and Petrochemicals Complex", Chemicals Technology, 19 Nov. 2008 (www.chemicals-technology.com/projects/dushanzirefinery/)

Integrated Turbine and Compressor Control (ITCC) Challenge

There were multiple control challenges involved with successfully completing this project. One was the detailed engineering required to implement triple redundancy logic for the high number of system inputs and outputs, ensuring system up-time and allowing for on-line repairs. A second was the engineering of specialized compressor algorithms to ensure correct control point calculations even with the use of multiple intercoolers within a single loop. Another challenge was the implementation of surge anticipation logic and loop optimization algorithms to ensure that each compressor train operates at its highest efficiency level no matter the compression load.



Woodward Equipment Installed

For each of the 3 trains, Woodward supplied the following:

- MicroNet TMR System
- Citect HMI
- 5009C software with minor modifications
- Entire Cabinet

Woodward Customization

The Dushanzi project requires a control system that can be custom programmed to meet the specific site operating requirements, with the flexibility to perform on-line dynamic and control changes. Woodward's GAP (graphical application programmer) programming environment was used to program the control, to integrate all system functionality, and to allow site engineers to make on-line system adjustments as needed. Woodward's compressor control engineers also customized the system control and protection logic at site, to improve the overall performance and allow for smoother start-ups.

MicroNet TMR with ITCC Logic

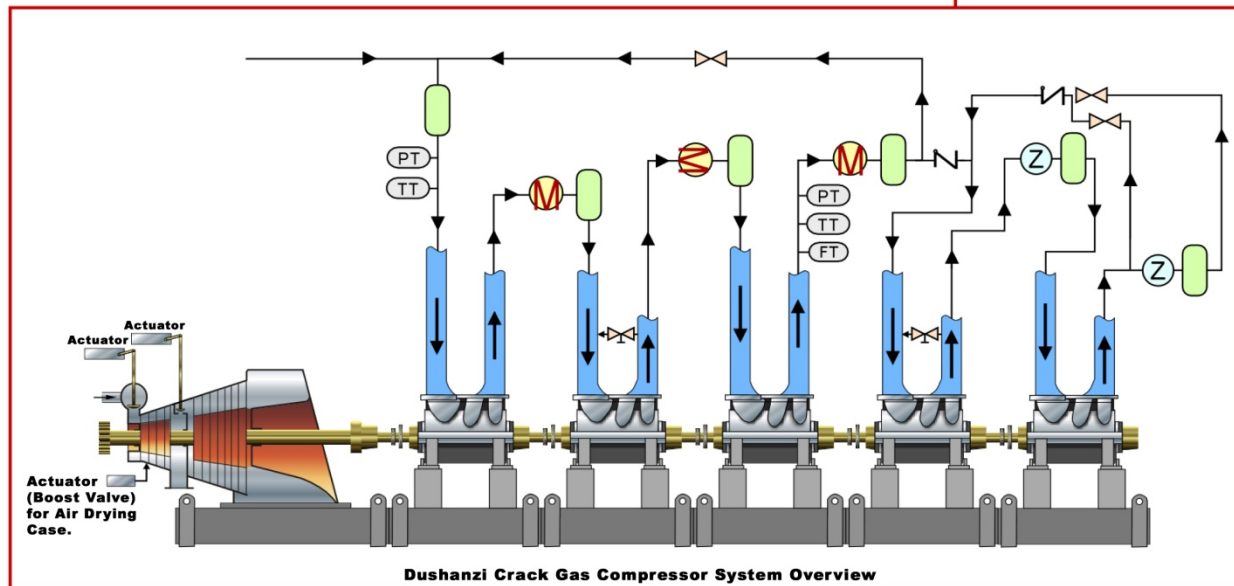
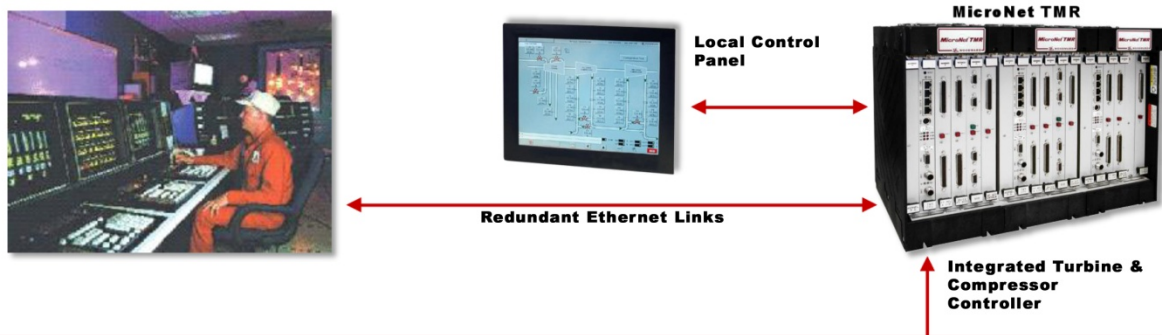
A MicroNet TMR based system was installed on each compressor train to start/stop, control, and protect the entire train. The MicroNet TMR is responsible for maintaining each compressor train at its optimum control point while protecting the compressor from reverse flow (surge) conditions in the event a plant upset or transient pushes a compressor loop towards its surge limit line. A MicroNet TMR control system was installed on each of the following plant compressor trains:

- Cracked gas compressor train - 5 stages
- Ethylene compressor train - 5 stages
- Propylene compressor train - 3 stages

To save cost and complexity, Woodward's Integrated Turbine Compressor Control (ITCC) algorithms were utilized within each turbine compressor train controller. The following major system functions were integrated within one Woodward MicroNet TMR system for each train:

- Turbine speed control
- Turbine overspeed protection
- Compressor anti-surge protection logic
- Compressor surge detection logic
- Compressor surge recovery logic
- Compressor performance control
- Unit start/stop sequence logic
- Turning gear logic (added)
- Suction pressure control
- Inlet pressure control
- Delta pressure protection
- Dual gas startup logic (air or charge gas)
- Extraction/exhaust temperature protection
- Decoupling logic from ITCC to speed setpoint
- Cascade bias logic with P2 override
- IEC61508 SIL-3 safety logic
- Lube oil control & protection logic
- Seal oil control (up to 6 PID loops)
- Water level/pump control





Dushanzi Cracked Gas Compressor System Overview



PO Box 1519, Fort Collins CO 80522-1519, USA
 1000 East Drake Road, Fort Collins CO 80525, USA
 Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058
 Email and Website—www.woodward.com

Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world. Complete address / phone / fax / email information for all locations is available on our website.

This document is distributed for informational purposes only. It is not to be construed as creating or becoming part of any Woodward contractual or warranty obligation unless expressly stated in a written sales contract.

Copyright © Woodward 2009, All Rights Reserved

For more information contact: