INTEGRATED TOWER CONTROL SYSTEM

ITC 9521 | TECHNICAL OVERVIEW

File No: 82.25
Date: FEBRUARY 05, 2018
Supersedes: NEW
Date: NEW

INTEGRATED TOWER CONTROL SYSTEM

The Armstrong ITC is a pre-programmed automation system for water based heat rejection / cooling systems.

The embedded robust control scheme delivers a responsive heat rejection process solution. It is designed for the automation of:

- Cooling towers or fluid coolers and their fans;
- Multiple variable speed Design Envelope pumps installed in a headered configuration;
- Associated control valves, both isolation and by-pass valves;
- Auxiliary heat rejection support systems such as water quality.

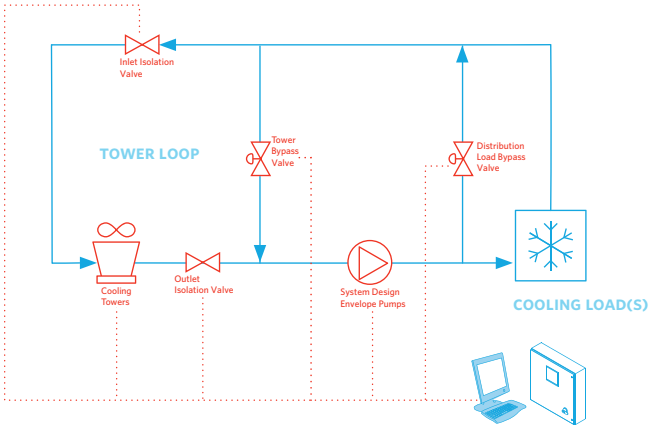
Automated control results in more accurate and predictable process results.

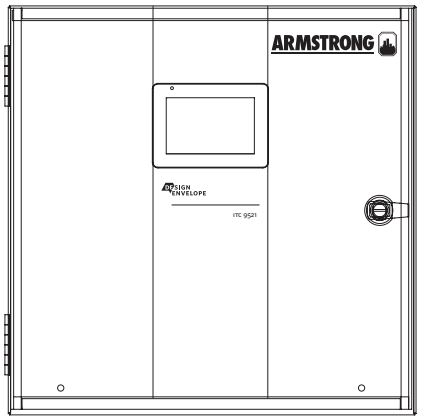
Leveraging the real time and accurate flow reading from the Design Envelope pumps, the system stability and tower automation can be optimized for energy efficiency. The optimization is enhanced by the Armstrong demand based control algorithms and industry-leading Parallel Sensorless™ technology.

Fully complementary and integrate-able, ITC can be tied into other automation systems, or building management systems.

It can be applied to heat rejection systems used in process applications such as, but not limited to:

- Data centres
- Ammonia compressors
- Automotive manufacturers
- Large circuit heat pump applications
- Condenser cooling
- Paint processes
- Injection molding
- Air compressors





stand alone power supply:
100V-240V AC / 50-60 Hz

Equipment	Control capacity
Cooling tower (Open cooling towers or evaporative fluid coolers)	Up to 5
Design Envelope pumps	Up to 5 single rotating assemblies
Inlet isolation valves	Same quantity as cooling towers
Outlet isolation valves	Same quantity as cooling towers
Tower bypass valve	1
Distribution load bypass valve	1

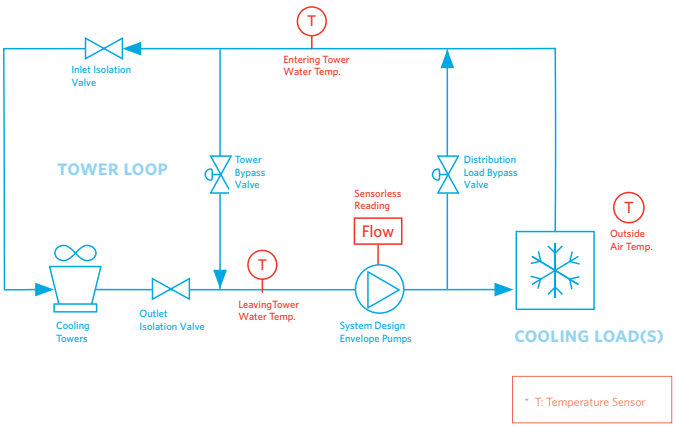
ADVANCED AUTOMATION AND OPTIMIZATION CAPABILITIES

Design Envelope demand based control is a feed forward control algorithm that enables variable water flow and air flow in the cooling towers. This reduces the amount of heat the cooling tower has to reject and the total amount power consumed while delivering the same leaving water temperature.

The high performance is achieved by accurate flow data to optimize the evaporative process. It receives the accurate flow from the Design Envelope pump in comparison, other flow sources are not as reliable in the cooling tower process.

Therefore, the tower flow is optimized based on an ongoing load calculation, allowing an optimization of the quantity of towers in operation. With respect to the operating Design Envelope pumps, the most efficient combination is based on the best efficiency approach staging (Parallel Sensorless™ technology).

The optimization can also allow the leaving water temperature to float within an acceptable operating range defined for each process for greater energy savings. If the application cooling load is not very high, it slows down the pumps and tower fan speed.



GENERAL CONTROL METHODS

Cooling plant

- The cooling plant can be enabled locally or based on a signal input (ex: BAS) and optionally on schedule or on outside air temperature signal (if a sensor is available).
- Manual operation mode (for commissioning): When the ITC is switched to manual operation mode, there is no automatic operation or sequencing of equipment. Operation of equipment can be manually set. When operation mode is switched back to auto, the automatic operation mode is restarted.

Cooling towers

- **Standard control:** Determines fan speed required to maintain a constant leaving temperature (labelled $T_{Leaving}$ in schematics).
- **Optimized control:** Determines optimized fan speed based on load within a field adjustable range (floating leaving temperature).
- Starts auxiliary equipment via dry contact digital output for water treatment (UV biological or chemical treatment). Same dry contact signal shall be used to start basin sweepers, if applicable.
- Where applicable, monitors ambient temperature and enables freeze protection equipment when necessary.
- With fluid cooler tower types, enables the circulator pump of the operating fluid cooler
- Condenser flow is obtained from design enveloped pumps sensorless reading capability.

Cooling tower staging

- Operates the most efficient quantity of towers to maximize the heat transfer surface area against incremental fan and pump power for minimum flow constraints.

Pump speed

- Responds to load side demand with sensorless control within equipment upper and lower flow limits. Requires Design Envelope pumps.
- Responds to heat load requirement of the process application
- Incorporates embedded logic to prevent hunting, pump flow surge, and motor overloading.

Pump staging

- **Staging:** Determines the most energy efficient combination of operation through Parallel Sensorless™ staging. Requires Design Envelope pumps.
- Rotates the pumps based on a field adjustable interval of operating hours with a bump-less transfer algorithm.
- Locks out and places in alarm any VFD /pump unit that fails. In place of the failed assembly, the next available VFD/pump unit is operated. All alarms are auto-reset.

Distribution load bypass valve

- When necessary, opens the system bypass valve to maintain the minimum flow required by the operating cooling towers.

Tower bypass valve

- When necessary, opens the bypass valve to prevent low leaving temperature to be supplied to the distribution. Diverting a part of the return flow from the distribution system and mixing it with the leaving water temperature from the tower(s) increases that leaving temperature (labelled $T_{Leaving}$ in schematics) sent back to the distribution system.

STANDARD FUNCTIONALITY AND CONSTRUCTION

Standard construction

- 10.4" color back-lit touchscreen LCD panel (PC touchscreen)
- Internal circuit breaker protection (power supply requirement is 100-240 VAC/1 pH/50-60 Hz)
- NEMA 12 rated cabinet with secure front door via lock and key
- Operation temperature range: 0°C - 45°C (32°F - 113°F) (must not be exposed to direct sunlight)
- Operation humidity range: 5% - 95%, non-condensing

Standard functionality

- Remote or local start/stop mode of operation
- Three level password security
  - Level 0 view only
  - Level 1 operator view (for equipment operation and field adjustment)
  - Level 2 installer view (for factory/commissioning)
- Manual or automatic control system (H-O-A selection)
- Color Touch screen operator interface with :
  - Active-element schematic displays with links to sub-menus for additional plant equipment information

- Detailed view of the hydronic circuit indicating operating status
- Capability to view and modify parameters and set points
- Capability to override equipment
- View all available live and historic data

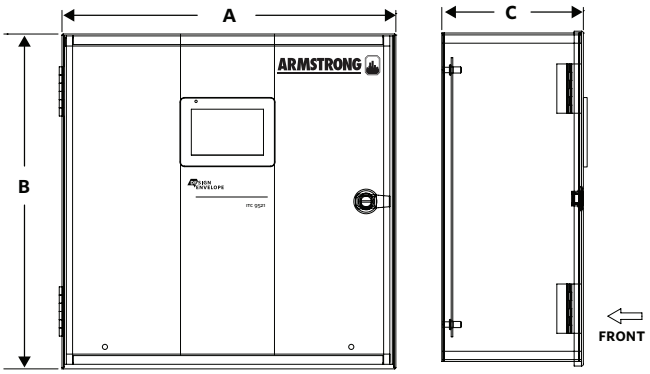
- Serial communication Modbus RTU between ITC controller and VFD's tower fans and pumps
- Digital outputs for cooling tower 2-way automatic on/off isolation valves
- Control of Single, dualArm or Tango Design Envelope pumps
- Automatic pump sequencing and alternation
- Automatic sequencing and alternation of cooling towers
- Pump control: Parallel sensorless™ mode.
- Control of open or closed style cooling towers
- Enable auxiliary equipment through dry contact output for water treatment

DIMENSIONS

PANEL DIMENSIONS

DIMENSIONS AND WEIGHT			
WIDTH	HEIGHT	DEPTH	WEIGHT
30.00 (762)	30.00 (762)	8.62 (219)	75 (35.0)

Note: Weights are approximate
Dimensions in inches (mm) Weights in lbs (kg)



OPTIONAL FEATURES

BAS Communication

☐ Not Required ☐ Modbus RTU ☐ Modbus TCP

☐ BACnet™ MS/TP ☐ BACnet™ IP

Panel environmental rating

☐ NEMA TYPE 12

☐ NEMA TYPE 4X* (recommended for outdoor application. Comprises a stainless-steel panel enclosure and a transparent non-metallic hinged inspection window protecting the screen.)

Panel approval

☐ UL (Standard) ☐ CSA

INPUT/OUTPUT

A point schedule detailing analog and digital input and output point description, functions and types for the following:

Digital inputs

- Remote start (through an external system; ex. BAS)
- Emergency stop (Push button in the mechanical room)
- Alarm silencer (Button or through external system)
- Cooling tower inlet isolation valve open feedback
- Cooling tower inlet isolation valve close feedback
- Cooling tower outlet isolation valve open feedback
- Cooling tower outlet isolation valve close feedback
- Tower recirculation pump running (For evaporative fluid cooler applications only)
- Tower sump low level switch
- Tower sump high level switch

Digital outputs

- Cooling tower inlet isolation valve
- Cooling tower outlet isolation valve
- Enable tower recirculation pump (For evaporative fluid cooler applications only)
- Enable water treatment (can also be used with enable auxiliary equipment via interposing relay)
- Enable freeze protection equipment
- ITC system alarm (Signal for external system – ex. BAS)
- General audible alarm (Signal for external system - ex. Horn or Siren)
- Enable IPS4000 or PSPC Armstrong secondary loop controller (For secondary pumps enablement, where applicable)

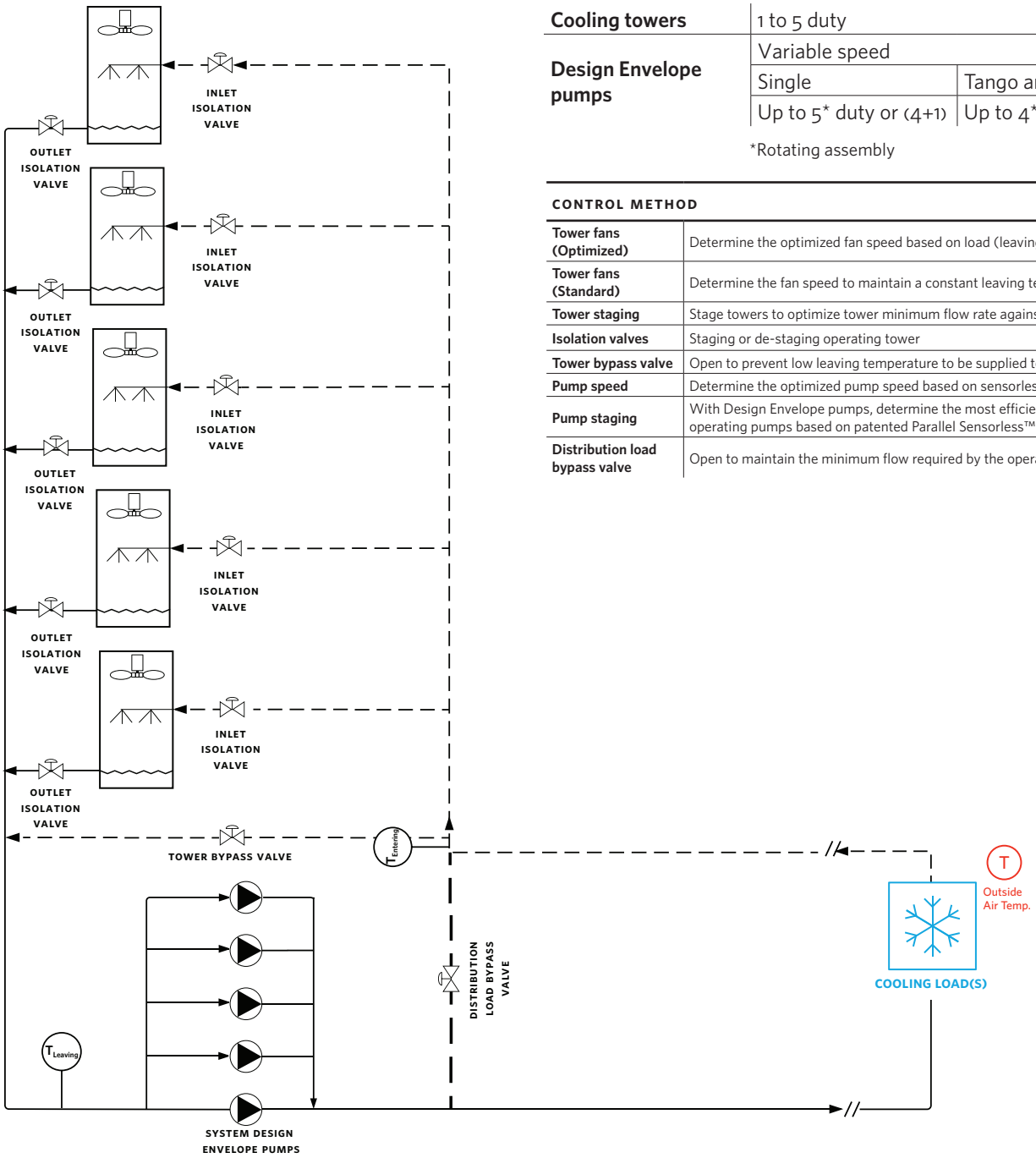
Analog inputs

- Entering tower temperature (4-20 mA signal)
- Leaving tower temperature
- Outside air temperature
- Outdoor air humidity
- Distribution load bypass valve position feedback (0-10V DC signal)
- Tower bypass valve position feedback

Analog outputs

- Tower bypass valve position setpoint (0-10V DC signal)
- Distribution load bypass valve position setpoint (0-10V DC signal)

OPEN COOLING TOWER(S)

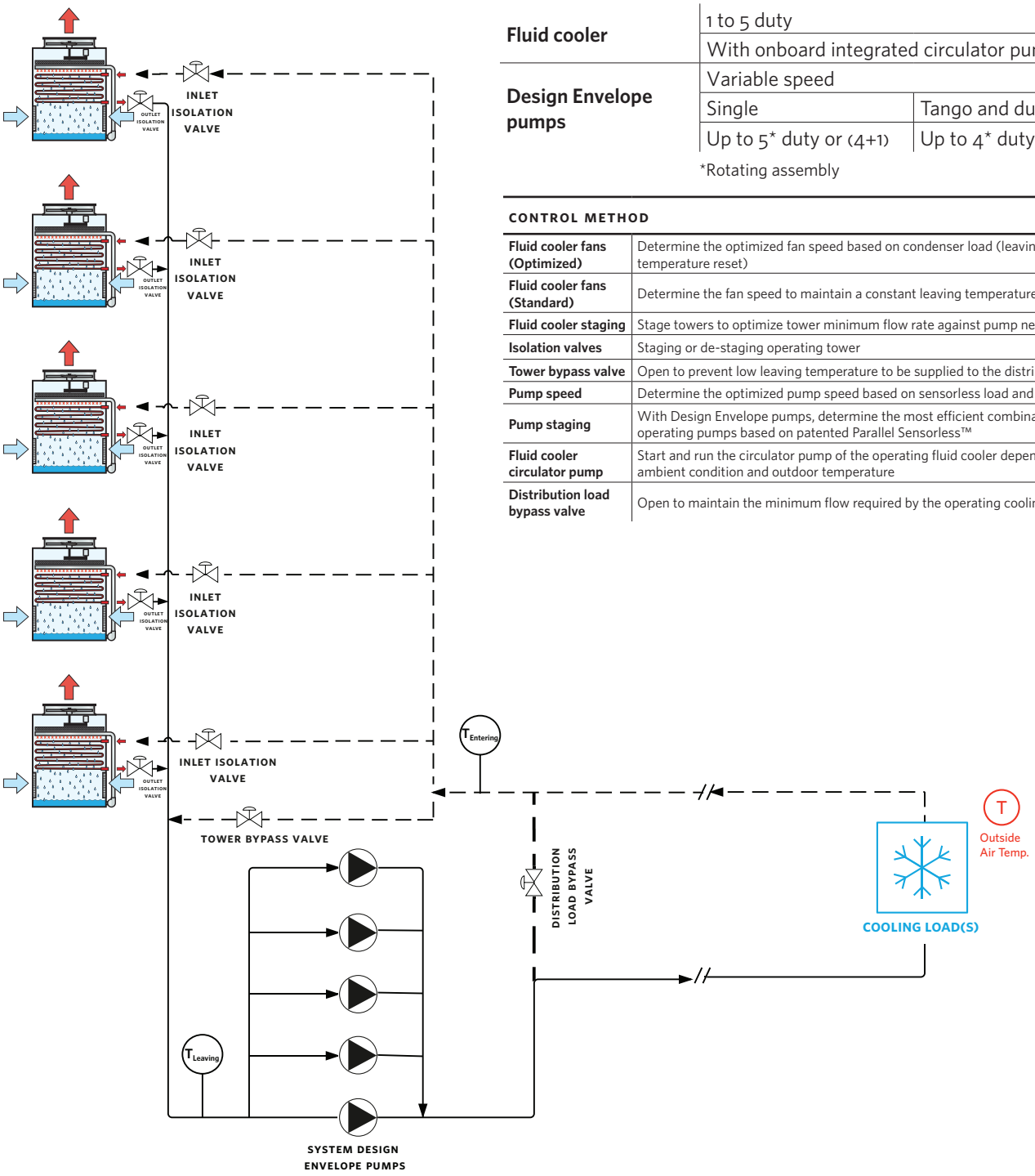


Cooling towers	1 to 5 duty	
Design Envelope pumps	Variable speed	
	Single	Tango and dualArm
	Up to 5* duty or (4+1)	Up to 4* duty or (3+1)

*Rotating assembly

CONTROL METHOD	
Tower fans (Optimized)	Determine the optimized fan speed based on load (leaving temperature reset)
Tower fans (Standard)	Determine the fan speed to maintain a constant leaving temperature
Tower staging	Stage towers to optimize tower minimum flow rate against pump needs.
Isolation valves	Staging or de-staging operating tower
Tower bypass valve	Open to prevent low leaving temperature to be supplied to the distribution
Pump speed	Determine the optimized pump speed based on sensorless load and heat load
Pump staging	With Design Envelope pumps, determine the most efficient combination of operating pumps based on patented Parallel Sensorless™
Distribution load bypass valve	Open to maintain the minimum flow required by the operating cooling towers

EVAPORATIVE FLUID COOLER(S) WITH HEAT EXCHANGER(S)



Fluid cooler	1 to 5 duty	
	With onboard integrated circulator pump	
Design Envelope pumps	Variable speed	
	Single	Tango and dualArm
	Up to 5* duty or (4+1)	Up to 4* duty or (3+1)

*Rotating assembly

CONTROL METHOD	
Fluid cooler fans (Optimized)	Determine the optimized fan speed based on condenser load (leaving temperature reset)
Fluid cooler fans (Standard)	Determine the fan speed to maintain a constant leaving temperature
Fluid cooler staging	Stage towers to optimize tower minimum flow rate against pump needs.
Isolation valves	Staging or de-staging operating tower
Tower bypass valve	Open to prevent low leaving temperature to be supplied to the distribution
Pump speed	Determine the optimized pump speed based on sensorless load and heat load
Pump staging	With Design Envelope pumps, determine the most efficient combination of operating pumps based on patented Parallel Sensorless™
Fluid cooler circulator pump	Start and run the circulator pump of the operating fluid cooler dependant on ambient condition and outdoor temperature
Distribution load bypass valve	Open to maintain the minimum flow required by the operating cooling towers

TORONTO

23 BERTRAND AVENUE
TORONTO, ONTARIO
CANADA
M1L 2P3
+1 416 755 2291

BUFFALO

93 EAST AVENUE
NORTH TONAWANDA, NEW YORK
U.S.A.
14120-6594
+1 716 693 8813

BIRMINGHAM

HEYWOOD WHARF, MUCKLOW HILL
HALESOWEN, WEST MIDLANDS
UNITED KINGDOM
B62 8DJ
+44 (0) 8444 145 145

MANCHESTER

WOLVERTON STREET
MANCHESTER
UNITED KINGDOM
M11 2ET
+44 (0) 8444 145 145

BANGALORE

#59, FIRST FLOOR, 3RD MAIN
MARGOSA ROAD, MALLESWARAM
BANGALORE, INDIA
560 003
+91 (0) 80 4906 3555

SHANGHAI

UNIT 903, 888 NORTH SICHUAN RD.
HONGKOU DISTRICT, SHANGHAI
CHINA
200085
+86 (0) 21 5237 0909

SÃO PAULO

RUA JOSÉ SEMIÃO RODRIGUES AGOSTINHO,
1370 GALPÃO 6
EMBU DAS ARTES
SAO PAULO, BRAZIL
+55 11 4781 5500

ARMSTRONG FLUID TECHNOLOGY
ESTABLISHED 1934

ARMSTRONGFLUIDTECHNOLOGY.COM

MAKING ENERGY MAKE SENSE™