IPS

ARMSTRONG

Integrated Pumping Systems

FILE NO:	90.10
DATE:	Nov. 1, 2005
SUPERSEDES:	90.10
DATE:	Jan. 15, 2000

Integrated Pumping Systems...The Concept.

Armstrong's Integrated Pumping System (IPS) automatically ensures delivery of required pumping capacity to match key building loads, while maintaining pumping energy costs at a minimum.

With the use of system load detectors, such as differential pressure sensors, at one or more remote load locations, the Armstrong IPS automatically and continuously provides just the required flow for the current needs.

HVAC system load requirements vary considerably during a typical day. Considerable energy savings result when pumping capacity is continuously matched to the load.

Pumps may be operated as 100% standby or in a multiple pump, staged parallel sequence.

Armstrong's IPS can control as many as six (6) pumps in parallel, with up to eighteen (18) remote system load sensors.

Dedicated Variable Frequency Drives (VFDs) may be used, with or without power bypass systems.

Armstrong offers the most advanced IPS available, with the flexibility to meet the most demanding pumping applications.

See the illustration on pages 3 & 4 for typical Integrated Pumping System (IPS) components.

Complete IPS Rack Assembly (2-Drives)

IPS 3000

IPS 5000

IPS 9000

Armstrong Integrated Pumping Systems.

Operational Energy Cost Reductions

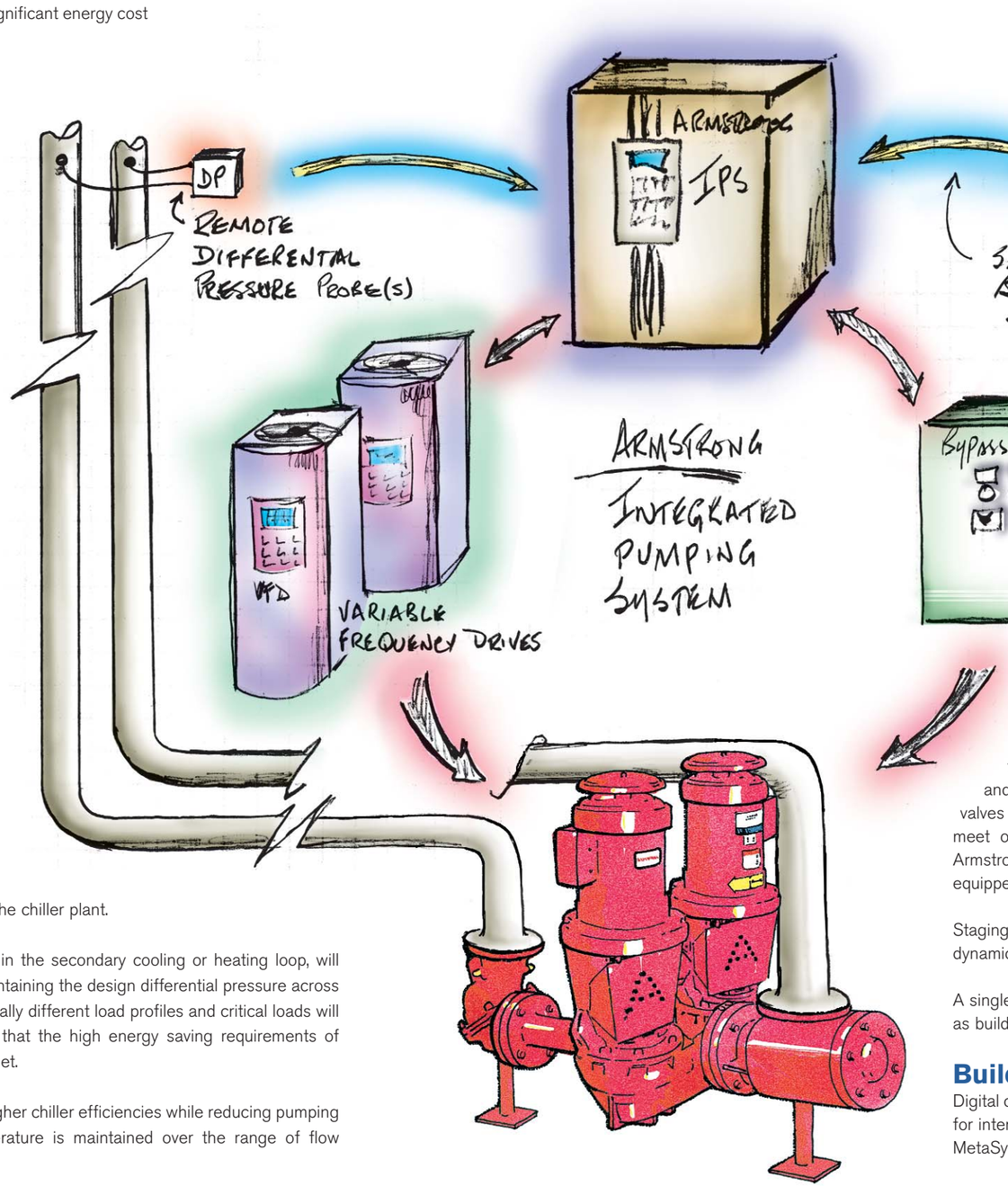
Variable speed pumping, in variable flow systems, results in significant energy cost reductions when compared to constant speed pumping.

Actual cost reductions realized by an Armstrong IPS varies with operation energy factors such as: cost of electricity, size and complexity of the piping distribution system, system load sensor location and building load profile. The number of pumps operating and motor sizes are also important factors.

Power costs for pumps operating at reduced speed, or reduced flow, are significantly lower than at full speed. The greater the speed reduction, the greater the power savings. This is true throughout the operating (load) flow profile. Since the design flow is often required for less than 5% of the load profile and the operating cost reductions are greatest at reduced load flows, variable speed points the way to significant energy cost reductions versus constant speed pumping.

Armstrong's DDC (Direct Digital Control) precision control maintains the speed of all operating pumps to within 1%, maximizing energy cost reductions.

The dedicated operation of the Armstrong IPS to the task of matching the system capacity to the current load ensures long-term continuation of projected energy cost reductions.



Integrated Pumping System Performance

Armstrong's IPS concepts should be considered for constant speed (CS) primary with variable speed (VS) secondary, or VS primary heating and cooling systems, condenser system differential temperature and differential temperature across the chiller plant.

Control of the differential pressure at various critical loads, in the secondary cooling or heating loop, will ensure system performance at the lowest delivered cost. Maintaining the design differential pressure across control valves (CV) at remote and near loads, loads with radically different load profiles and critical loads will allow effective CV operation, ensuring tenant comfort and that the high energy saving requirements of ASHRAE 90.1 standards for energy efficient buildings are met.

Precise condenser differential temperature control permits higher chiller efficiencies while reducing pumping costs of condenser loops. Cooling tower discharge temperature is maintained over the range of flow appropriate to the towers by staging the tower fans.

After the distribution system is proportionally balanced, the Armstrong IPS takes over to automatically fine tune the system head to the current load. This function is performed continuously throughout the day, to ensure the load is satisfied at the lowest possible delivery cost.

Pump damage from cavitation and excessive vibration, due to insufficient NPSH, is eliminated by standard "End Of Curve" protection.

Pump alternation can be initiated automatically, based on run hours. Rotation time interval is easily set on the touch-screen display. Optional Minimum Suction Pressure Setting is also on the touch-screen display.

Family of Controllers

At the head of the Integrated Pumping System is an IPS Controller - which is available as a stand-alone component or as part of a pre-engineered, pre-wired rack assembly including variable frequency drives and bypasses.

The family of controllers include the 3000, 5000 and 9000 models, each characterized by functionality and control limits as indicated in the matrix on the following page.

Technological Advancement

Touch-screen operator interface on the IPS 5000 & IPS 9000 allows easy and clear access to controller, pump and sensor settings and present readings for commissioning and operational information. Similarly accessible information on power usage, system efficiency, pump staging, chiller staging and by-pass valve data on variable primary flow systems and much more is available at the touch of the screen. Three levels of security allow access to be limited to authorized personnel only.

IPS systems operate well on single sensor control. Pump speed and staging is controlled to system needs. For complex system sensors placed across control valves (CV) at remote and near loads, loads with radically different load profiles and critical loads will ensure control valves remain operate with effective valve authority and maximum energy savings are achieved that meet or exceed the requirements of ASHRAE 90.1 standards for energy efficient buildings. Armstrong IPS systems can also operate without sensors if the building automation system (BAS) is equipped to send current CV stem positions to the IPS controller.

Staging of multiple pumps with the Armstrong IPS may be based on pre-set switching levels or dynamically measured energy performance.

A single remote sensor permits initial operation with the IPS. More sensors may be added initially, or as building loads and needs change.

Building Automation System (BAS) Interface

Digital communication is available with the IPS, without the expense of a PC. This facility may be used for interfacing to the BAS. Protocols available with the IPS include Modbus, LonWorks, BACNet and MetaSys Open N2*.

*MetaSys requires a Johnson Controls Integrator to be supplied by a local Johnson Control vendor

Integrated Pumping System - System Responsibility

"Who Is Responsible?"

- To Resolve an Issue
- To Diagnose a Problem
- To make Commitments & Take Action
- To provide Solutions
- To overcome Technical & Financial Risks

Armstrong is with the IPS!

Armstrong provides the key single source responsibility for the Integrated Pumping System.

Your project can start with expert assistance from the Armstrong team. Armstrong's IPS design and specification assistance will assure you of an advanced reliable design with built-in energy efficiency.

All Armstrong IPS components are carefully selected and interfaced as an integrated system to assure trouble-free start-up and effective operation.

Documentation begins with project specific submittal data and ends with a comprehensive operator's manual. On-site operator training is a standard and vital component of each Armstrong IPS.

The Armstrong team has the pumping system expertise to ensure a successful IPS installation. The service network provides the long-term support you require.

IPS Controllers Capability and Feature Matrix

			Control Limits			Operator Interface (HMI)	Special Features
			Zones	Pumps	Chillers/Boilers		
IPS 3000		3001	2	3	N/A	4x20 backlit LCD, 6 buttons, 4 LED keypad	Variable secondary; Built-in protocols
		3002	5	4			
IPS 5000		5001	5	4	N/A	5.7" touch-screen, backlit	Variable secondary; Optional flow sensor input(s); Customized programming
		5002	8	4			
		5003	11	4			
IPS 9000	9100	9101	6	6	N/A	10.4" 256-color touch-screen with system schematics and variable display	Variable secondary; Speed matching on pump staging; Staging/de-staging on VFD bypass
		9102	12	6			
		9103	18	6			
	9200	9201	6	6	N/A	10.4" 256-color touch-screen with system schematics and variable display	Constant Primary and Variable Secondary pump control; Speed matching on pump staging; Staging/de-staging on VFD bypass
		9202	12	6			
		9203	18	6			
	9500	9501	6	4	3	10.4" 256-color touch-screen with system schematics and variable display	Variable Primary; Speed matching on pump staging; Chiller sequencing/flow control
		9502	12	5	4		
		9503	18	6	5		

Integrated Pumping System - General Sequence of Operation

The Armstrong Integrated Pumping System (IPS) provides a means of automatically ensuring delivery of required pumping capacity to match key building loads, while maintaining pumping energy costs at a minimum.

Using system load detectors, such as differential pressure sensors, at one or more remote load locations, the IPS detects where a deficiency in flow is occurring and adjusts the flow rate to match the requirement, by adjusting the pump speed.

The pump speed can be lowered, to reduce flow, when the differential pressure is above that required at all locations. The Armstrong IPS continuously and automatically makes these precision adjustments to match the pumping flow to the current load requirements.

Variable Frequency Drives (VFDs) may be used, with or without power bypass systems. Pumps may be operated as 100% standby or in a multiple pump staged parallel sequence.

Where the pumping system consists of a single operating pump, with a 100% standby pump, the operating pump speed will be modulated throughout the operating range.

Factory set *End of Curve Protection* will operate to protect the pump. Pump speed and pressure is closely monitored to protect against this possible service life reducing condition. Pump speed corrections will continue to achieve the load requirements, while monitoring the *End of Curve* condition at each speed setting.

Where multiple pumps are operating in parallel the precise DDC control capability of the Armstrong IPS controller ensures that the speed of all pumps is maintained to within ± 1%.

The Armstrong IPS provides this precision speed control of each pump with a *Closed Loop* DDC control. The electronic signal level to each VFD is continually checked and adjusted to automatically keep the actual pump speed at the required setting.

This precision control is one of the very significant factors which is essential to the application of an Armstrong IPS.

Where multiple parallel pumps are sequenced through the load profile, pumps will be added to the operating set, only after an unsatisfied load requirement has persisted for a fixed staging time interval.

As an additional pump is activated, the speed of the operating pumps is reduced to the pre-set staging level. The speed of all pumps is then increased to meet the load requirements. A similar sequence occurs when staging OFF one of the operating pumps. This *Soft System Staging* ensures smooth staging transition and prevents flow or power surges.

The Armstrong *Plant Efficient Staging* option sets the staging points based on the actual monitored operating efficiency of the pumping plant. The Armstrong IPS continuously monitors energy consumption throughout the plant flow range for each combination of operating pumps. Using the on-line data, the decision to switch is based on the automatic selection of the known highest energy efficiency operational state.

The Armstrong IPS may consist of up to six (6) parallel pumps with as many as eighteen (18) remote sensors.

Armstrong offers the most advanced Integrated Pumping System available...
with the flexibility to meet the most demanding pumping applications.

EXPERIENCE BUILDING...

S. A. Armstrong Limited
23 Bertrand Avenue
Toronto, Ontario
Canada, M1L 2P3
T: (416) 755-2291
F (Main): (416) 759-9101

Armstrong Pumps Inc.
93 East Avenue
North Tonawanda, New York
U.S.A., 14120-6594
T: (716) 693-8813
F: (716) 693-8970

Armstrong Holden Brooke Pullen
Wenlock Way
Manchester
United Kingdom, M12 5JL
T: +44 (0) 161 223 2223
F: +44 (0) 161 220 9660

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