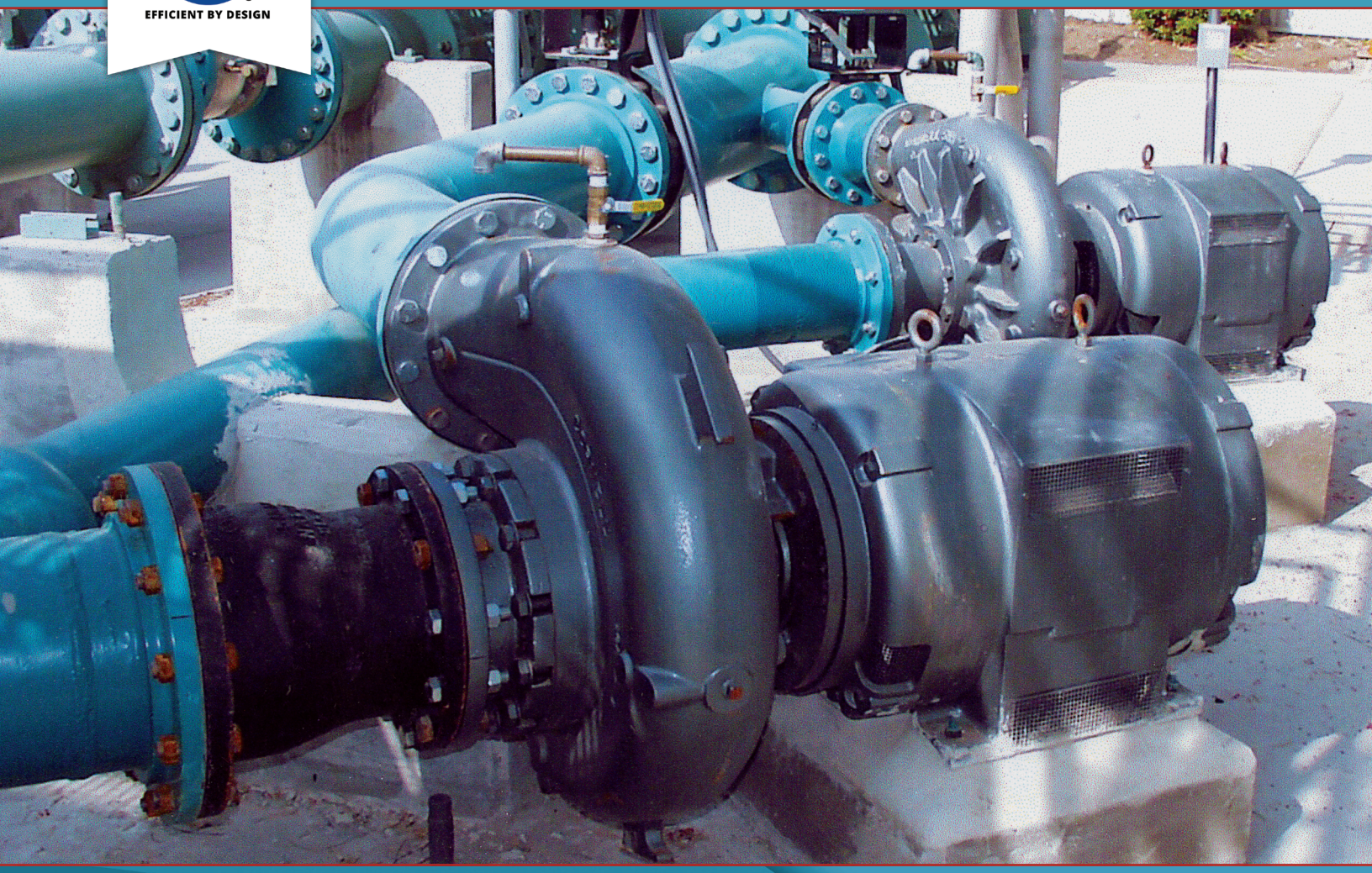
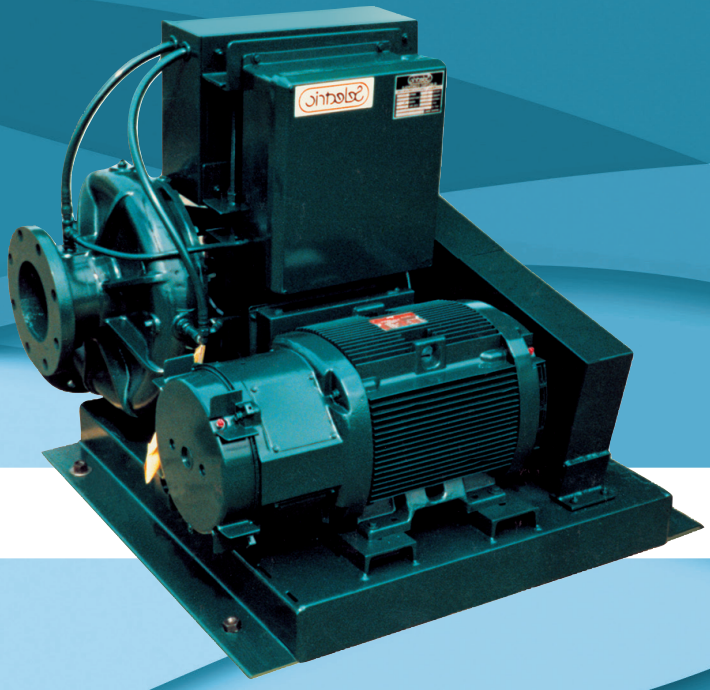
CORNELL PUMP COMPANY

HYDRO TURBINES

GENERATE POWER FROM EXCESS HEAD

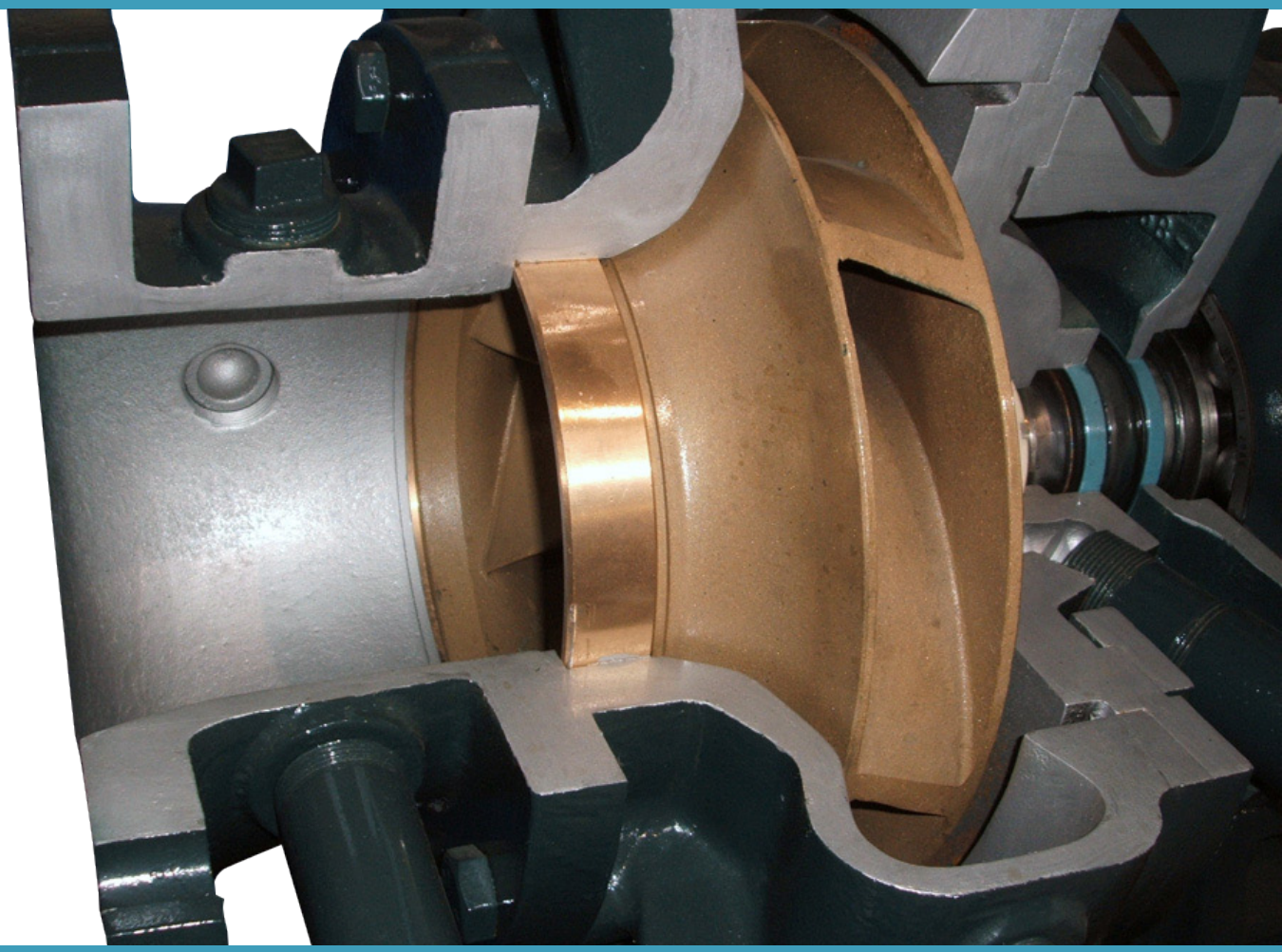
CORNELL
EFFICIENT BY DESIGN





EFFICIENT BY DESIGN

HYDRO TURBINES



PUT EXCESS HEAD TO WORK FOR YOU

Industrial plants, municipalities, HVAC installations, and farms are tapping potential hydraulic energy sources to produce electric power as a revenue source, or as a means to reduce overall energy demands. The key to the system is the use of excess head to drive a turbine. The turbine may be used to drive a pump, a generator, or other power-requiring device. This technology makes it feasible for cities, farmers, resort managers, industrial plants and building managers to consider hydro turbines in their plant power needs. Studies show that a turbine, driven by water from a natural stream or process stream, can generate enough electric power to pay for itself in a short time.

LOW-MAINTENANCE, HIGH EFFICIENCY DESIGNS

You don't need a raging river to take advantage of the energy savings a Cornell hydro turbine can provide. Heads as low as 50 feet, and flows as low as 90 gallons per minute can produce useable energy. Cornell's high turbine efficiency is often found to be comparable with specially-built imported turbines. They are less complex, easier to install and require less maintenance. Cornell turbines are available in a wide range of configurations and mounting styles. Cornell's approach to turbine applications has generated many new and innovative design features, resulting in unexpectedly high performance.

CORNELL SUPPORT FROM THE START

This high performance can be documented by actual performance tests on ordered units, conducted in Cornell's modern hydraulic lab under controlled conditions, by professional engineers. Let Cornell staff engineers and sales staff provide specialty application and selections assistance. Whether your needs are demanding, requiring turbines in series or parallel, or utilize a single unit, Cornell will assist in your selection of a hydro turbine.

TYPICAL CONFIGURATIONS

GENERATOR TYPES

INDUCTION

The generator must be connected to an existing power grid. The speed is controlled by virtue of being connected to the grid, the same way motor speed is maintained. It requires an automatic disconnect from the grid for when grid power fails.

SYNCHRONOUS

The generator is stand alone. It can be used where there is no electrical grid nearby. It requires a load controller (not provided by Cornell) to maintain standard speed, voltage and phase.

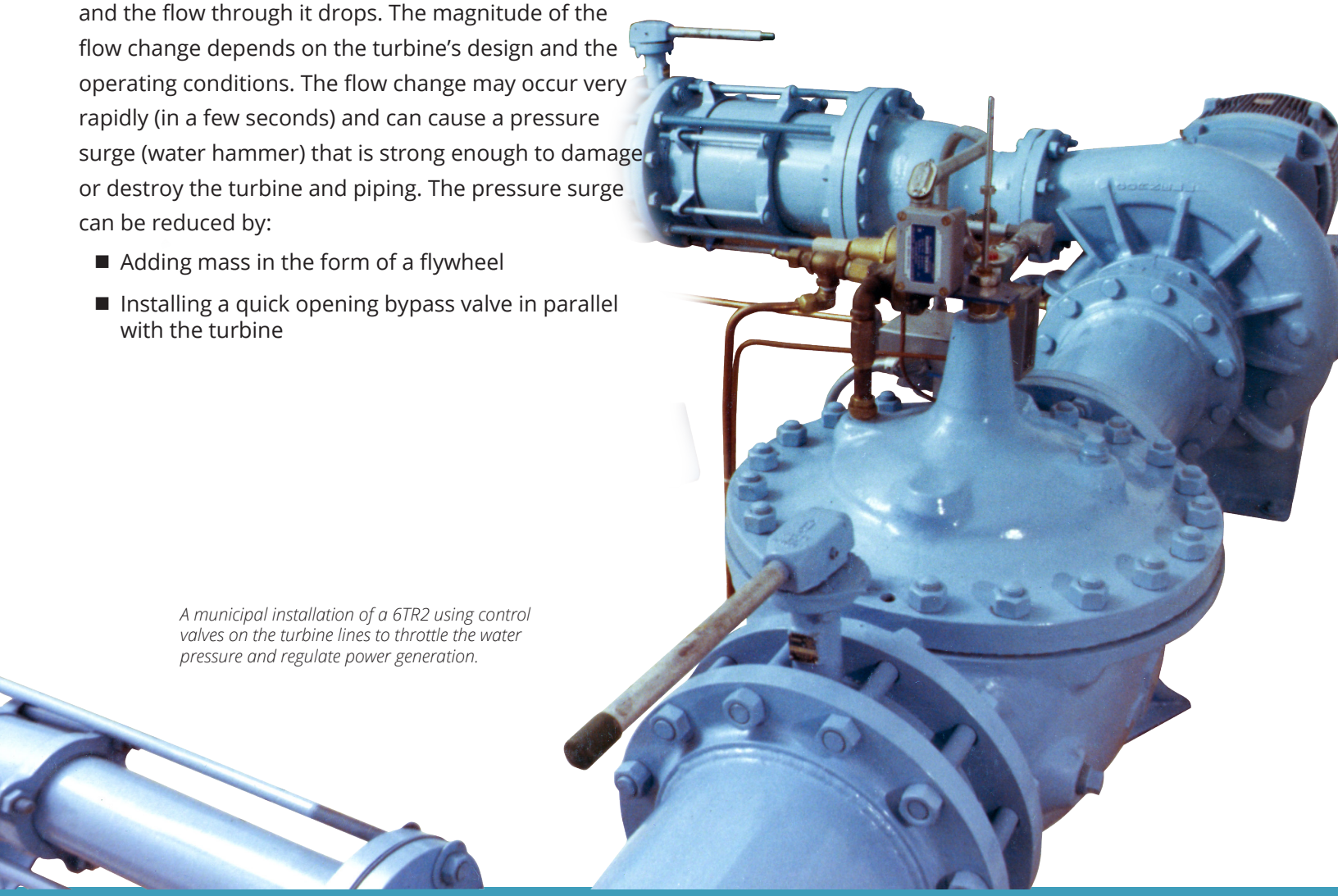
PRESSURE SURGE (WATER HAMMER) PROTECTION

During grid power loss, a reaction turbine speeds up and the flow through it drops. The magnitude of the flow change depends on the turbine's design and the operating conditions. The flow change may occur very rapidly (in a few seconds) and can cause a pressure surge (water hammer) that is strong enough to damage or destroy the turbine and piping. The pressure surge can be reduced by:

- Adding mass in the form of a flywheel
- Installing a quick opening bypass valve in parallel with the turbine

CONTROLS

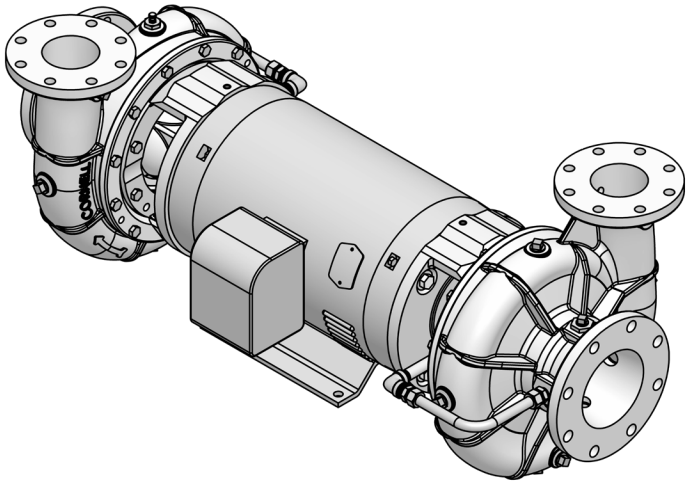
Hydro turbines need to be equipped with a control valve at the inlet of the turbine. This valve serves as an isolation device and can be used to control the head and flow through the turbine. The controls should include speed measuring devices. The control system should be designed so that during normal operation electrical contact is made or broken at or near the generator nominal (no load) speed. When power fails, the control system must break the electrical contact and close the inlet valve. It is advisable to contact your utility to determine if there are any special requirements.

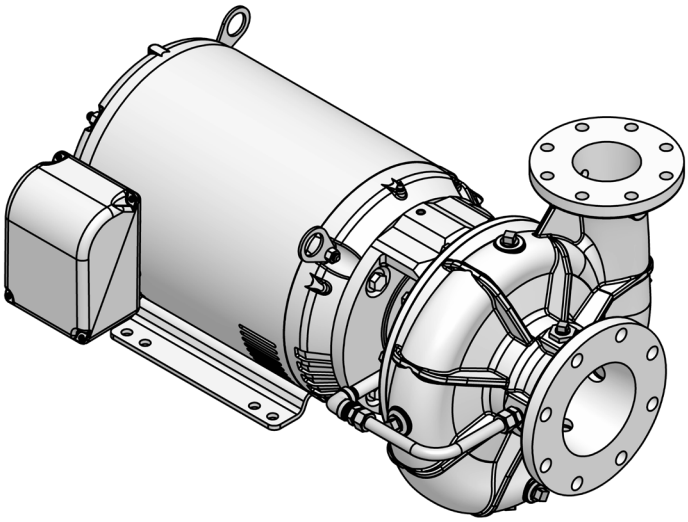


A municipal installation of a 6TR2 using control valves on the turbine lines to throttle the water pressure and regulate power generation.

HYDRO TURBINES

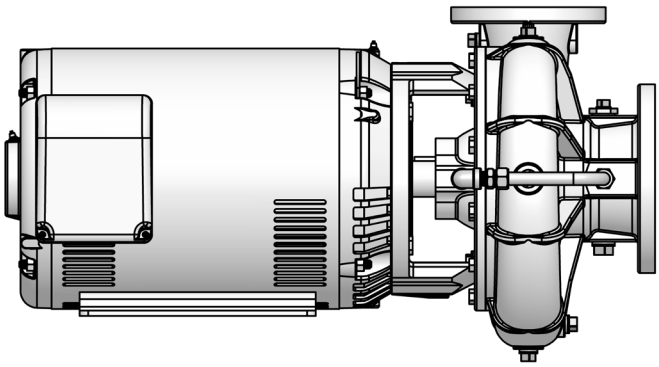
STANDARD TURBINE CONSTRUCTION	
Turbine Body	Cast Iron, Bronze fitted is standard. Ductile Iron, Steel, Bronze, or Stainless Steel models also available.
Seal	Mechanical shaft seal is standard, packing is optional.
Generator	Standard ODP generator-optional TEFC.

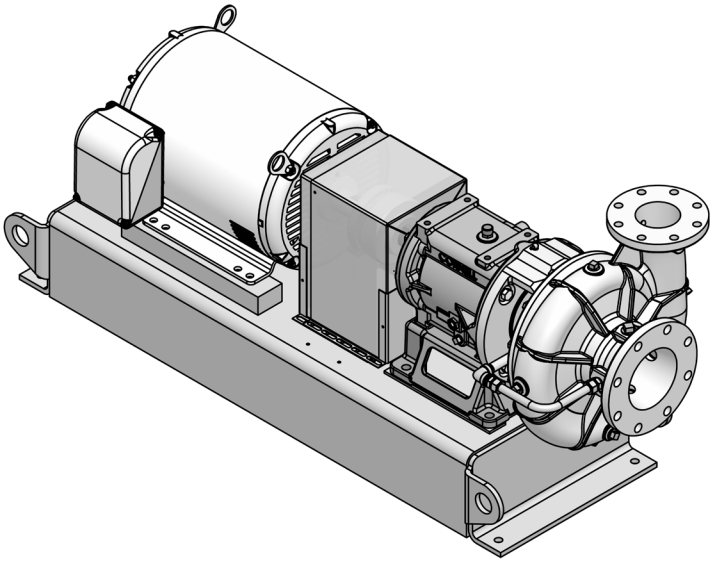




CLOSE-COUPLED, DOUBLE ENDED

This assembly allows the turbine to reduce a pumping load. The pump and turbine share a common motor, with the turbine one end and the pump on the other. Both are close-coupled, with all the features to suit a special installation. Especially suited to HVAC installations.





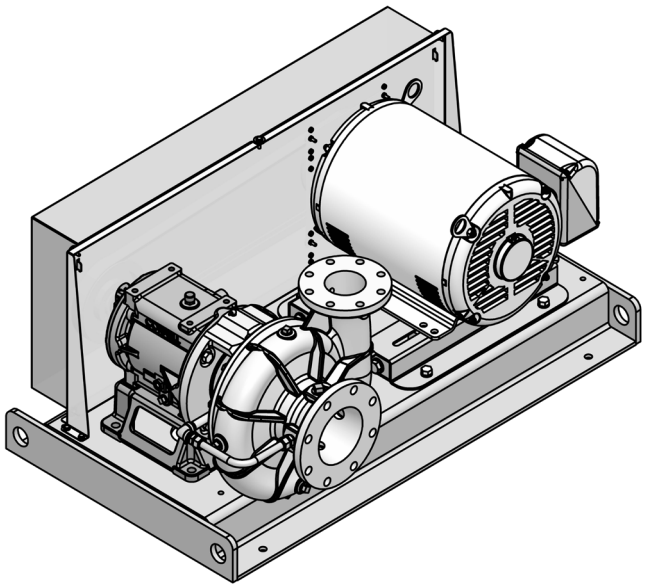
CLOSE-COUPLED

A close-coupled design is the simplest of assemblies. There is no coupling to align and it saves space. Available only with induction generators.

FRAME-MOUNTED WITH GENERATOR

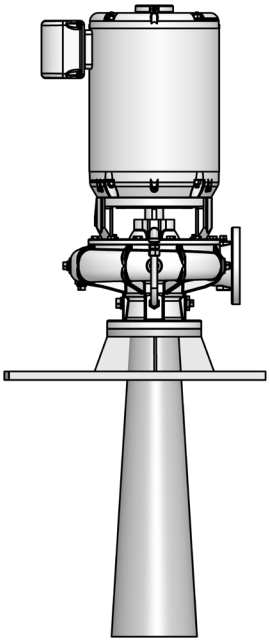
A frame-mounted turbine can be coupled to a generator and assembled on a fabricated steel base.

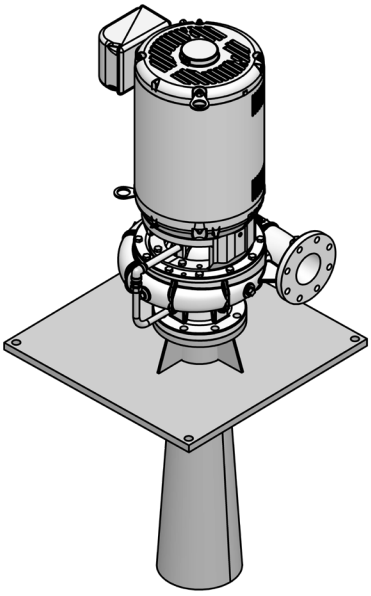
HYDRO TURBINES



SIDE-BY-SIDE BELT DRIVE

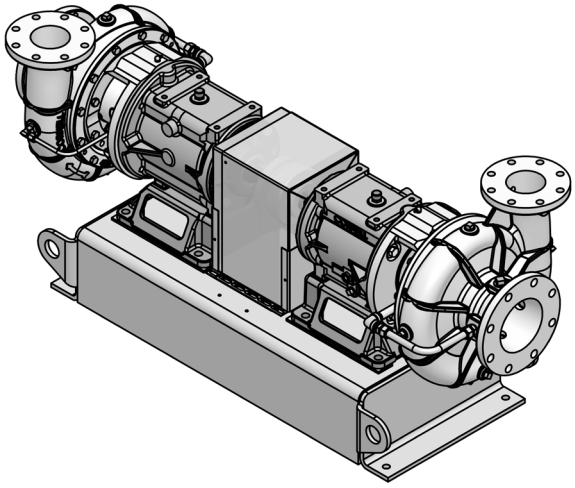
When space does not allow for a standard frame mount unit, it may be possible to belt drive the generator.





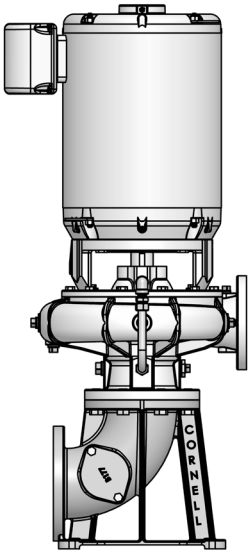
CLOSE-COUPLED VERTICAL WITH CUSTOM DRAFT TUBE

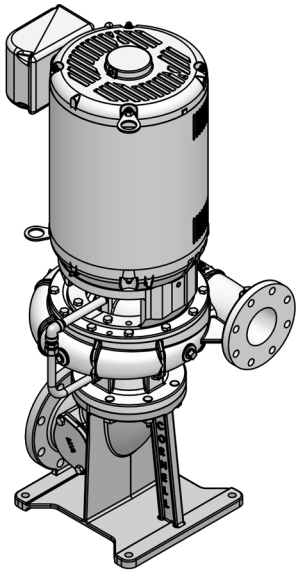
For added space saving or simplicity of manifolding, close-coupled, vertical mount with custom draft tube (available less draft tube for discharge manifold mounting).



FRAME MOUNT DRIVING A PUMP

Especially useful when a low head, high flow water source is available to provide power for a pump moving water to a higher elevation.





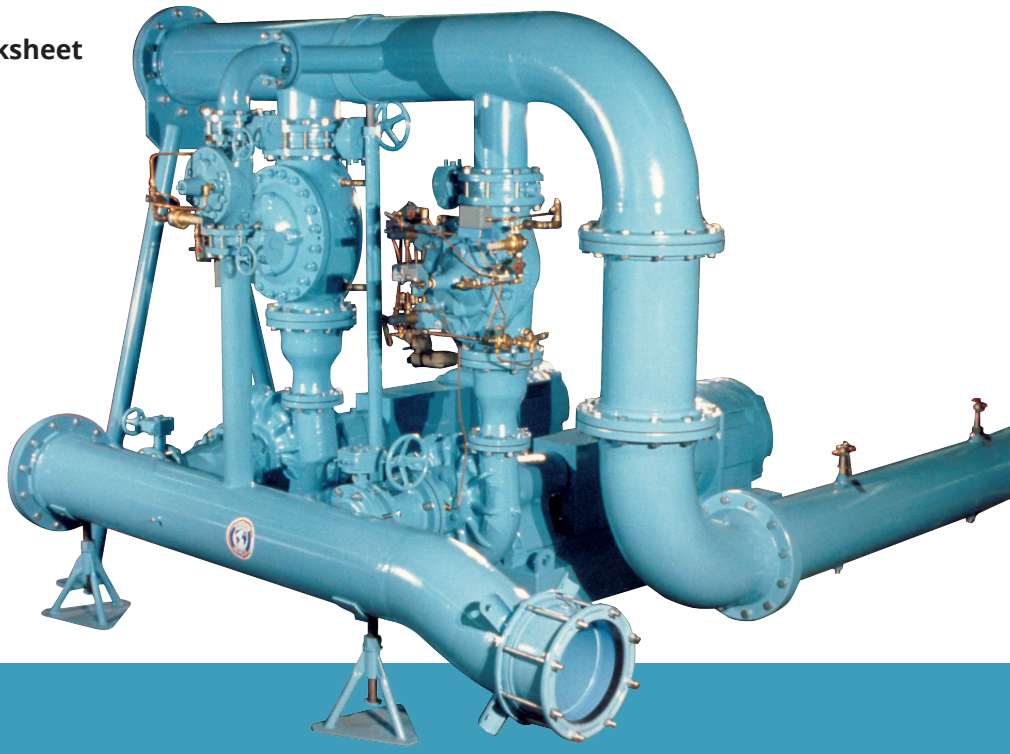
CLOSE-COUPLED VERTICAL WITH BASE ELBOW

When floor space is at a premium, a vertical unit may be the best option.

HYDRO TURBINES

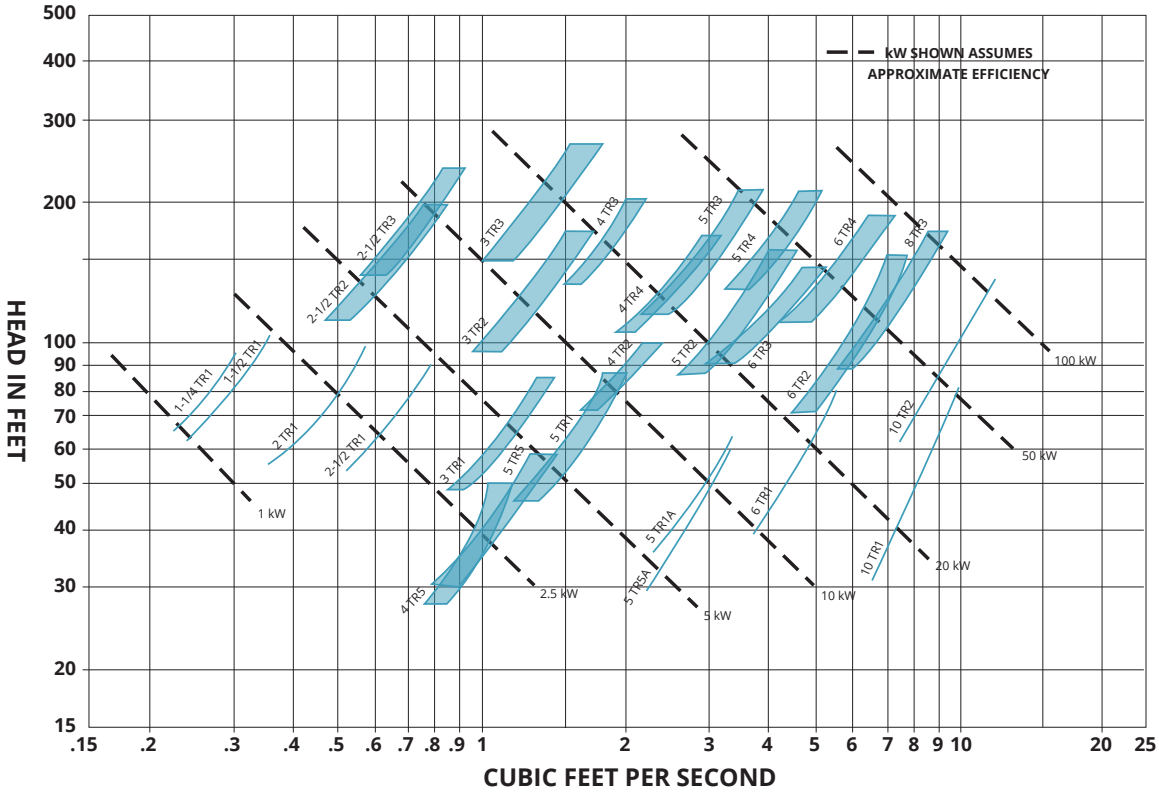
HYDRO TURBINE DATA WORKSHEET (for Preliminary Evaluation)					
PROJECT NAME					
CONTACT NAME					
ADDRESS					
PHONE					
EMAIL					
SITE INFORMATION					
WATER SOURCE	☐ STREAM ☐ RESERVOIR (USES ENTIRE SYSTEM HEAD)				
GROSS HEAD (STATIC)		**NET HEAD (INCLUDES FRICTION LOSS)**		**AVAILABLE FLOW**	
PENSTOCK DIAMETER			**PENSTOCK LENGTH**		
PRESSURIZED SYSTEM (PRESSURE REDUCTION)					
INLET PRESSURE		**OUTLET PRESSURE REQUIRED**		**DESIGN FLOW**	
ELECTRICAL CHARACTERISTICS					
MOTOR TYPE	☐ INDUCTION (GRID INTERFACE) ☐ SYNCHRONOUS (STAND-ALONE)			☐ ODP ☐ TEFC	
VOLTAGE		**PHASE**	☐ THREE ☐ SINGLE	**CYCLES (HERTZ)**	☐ 60 HZ ☐ 50HZ

Complete this form online at
www.cornellpump.com/hydro-turbine-worksheet
for evaluation by Cornell staff.

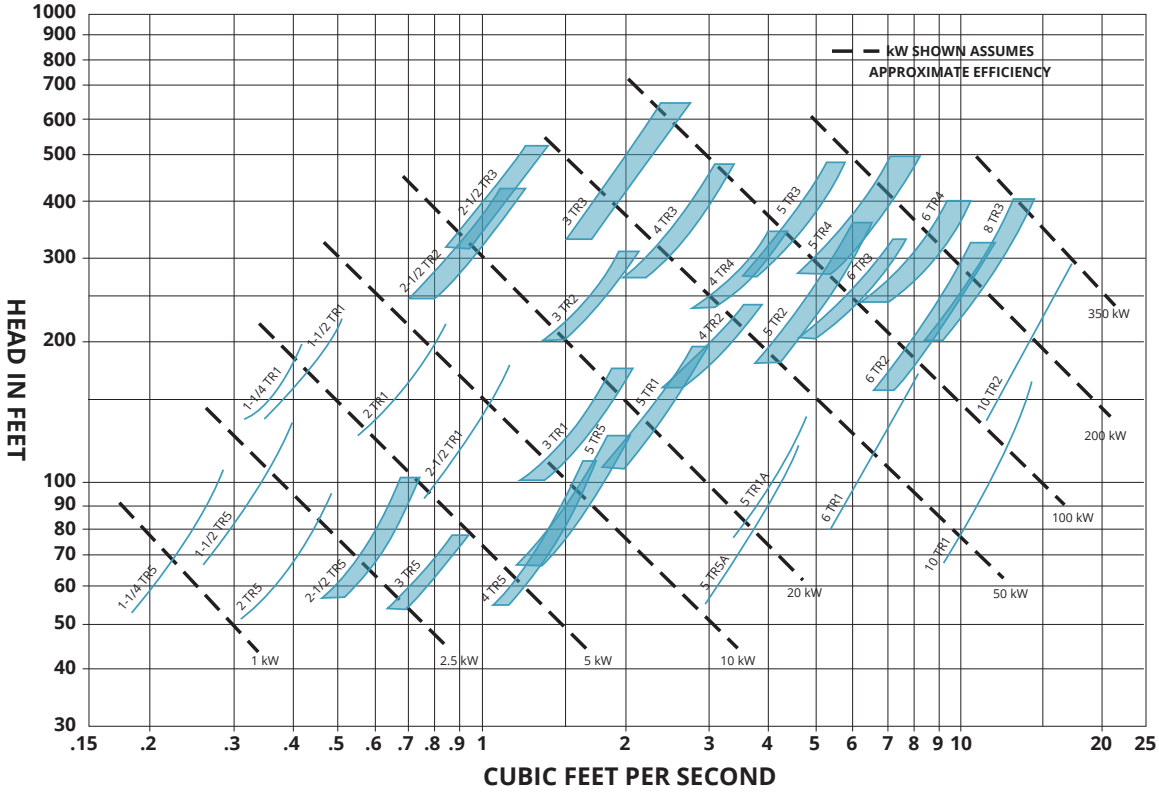


Two units in parallel between an inlet manifold above and outlet manifold below.

TURBINE SELECTION CHART - 1200 RPM



TURBINE SELECTION CHART - 1800 RPM

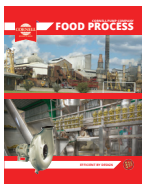


CORNELL®

EFFICIENT BY DESIGN

MARKET AND PRODUCT LINE

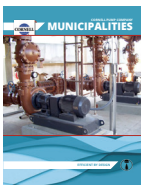
AGRICULTURE



FOOD PROCESS

INDUSTRIAL

MINING

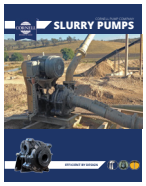


MUNICIPAL

WATER TRANSFER

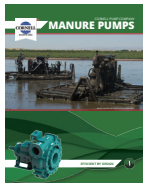
REFRIGERATION

CONSTRUCTION

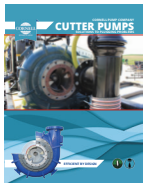


SLURRY

SLURRY SM

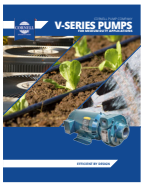


MANURE



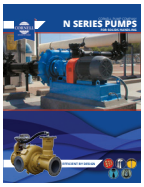
CUTTERS

SELF PRIMING



V SERIES

MX SERIES



N SERIES

Q-MAX

EDGE™

HYDRAULIC SUBS

IMMERSIBLE

CD4MCU

RUN-DRY™

PRIMING SYSTEMS

CYCLOSEAL®

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