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POMPE FEDCO E POMPE MULTISTADIO

FEDCO PUMPS AND MULTISTAGE PUMPS

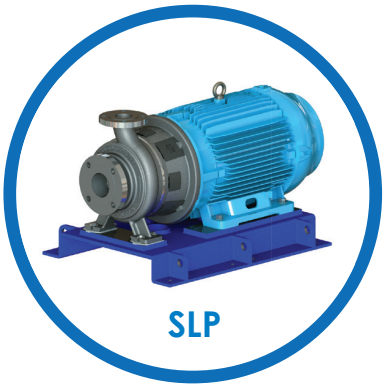
hytek | Hydrotecnologies

POMPE FEDCO IL TUO UNICO PUNTO DI RIFERIMENTO PER LA SCELTA DI POMPE E SISTEMI PER IL RECUPERO ENERGETICO/ FEDCO YOUR SINGLE SOURCE FOR PUMPS AND ENERGY RECOVERY SYSTEMS

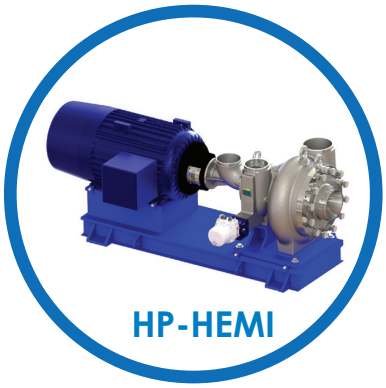

HPB


LPH


MSD


SLP


MSS


HP-HEMI

Il vantaggio di scegliere FEDCO
Il team FEDCO, composto da ingegneri talentuosi, operatori specializzai e collaboratori esperti di sistemi, hanno creato un'azienda completamente integrata con un unico obiettivo: fornire ai clienti macchine personalizzate ad eccezionale efficienza e a costi ridotti, il tutto abbinato ad un servizio capace di supeare ogni aspettativa. Il risultato di tutto questo porta a nuove tecnologie, standard produttivi e progetti innovativi.

Il nostro obbiettivo: dedicarsi ai sistemi a membrana
FEDCO progetta macchine per fluidi capaci di sfruttare al meglio le caratteristiche tecniche del processo su membrana. Le pompe FEDCO sono realizzate per fluidi e pressioni derivanti da applicazioni di acque salmastre e di mare (BWRO-SWRO). Esse vengono progettate per fluidi puliti ed ottimizzate per le pressioni tipiche dei sistemi RO. I nostri ERD sono composti da ugelli con un' area variabile in modo da soddisfare le variazioni di pressione sullo scarico. I nostri prodotti non necessitano di tubazioni esterne ad alta pressione che possono generare rischi sia per il personale che per le attrezzature. Le nostre unità vengono progettate in maniera tale per cui la loro manutenzione risulta semplice anche per il personale non specializzato e operante in ambienti difficili (desertici o marini). Le nostre pompe ERD utilizzano dei cuscinetti direttamente lubrificati dal fluido in alimento o in scarico, questo per eliminare i frequenti problemi di manutenzione causati invece dai sistemi a cuscinetto con lubrificazione ad olio o a grasso. FEDCO produce con materiale in Duplex SS, Super Duplex SS e 316 SS.

La nostra tecnologia
Grazie al riscontro dei clienti e ad anni di continuo perfezionamento, hanno portato FEDCO a sviluppare un know how tecnico chiave sia sulle pompe che nelle pompe ERD.

CUSCINETTI AD ACQUA (WATER BEARING ™)
Il sistema WATER BEARING ™, elimina praticamente tutta la manutenzione dei cuscinetti e i numerosi guasti imputabili ai

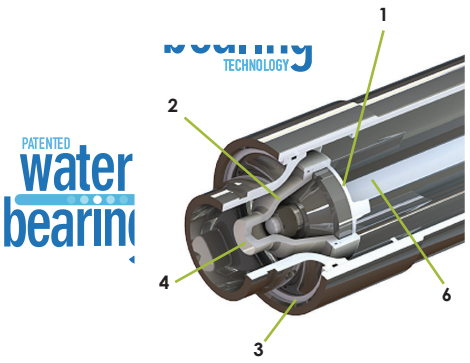
The FEDCO Advantage
Our teams of talented and energetic engineers, manufacturing specialists and systems experts have created a fully integrated enterprise with one aim - to provide our customers with customized fluid machines with exceptional efficiency and low capital cost coupled with customer service that exceeds their expectations. The results include new designs, technology, manufacturing processes, and standards.

Our Design - Focused on Membrane Systems
FEDCO designs fluid machines to take full advantage of the technical characteristics of the membrane process. FEDCO pumps only cover fl ows and pressures found in BWRO and seawater SWRO applications. They are designed for clean fl uids and are optimized for typical suction pressures in RO systems. Our ERDs include variable area nozzles that meet typical brine pressure variations. Our products eliminate external tubing carrying high pressure feed or brine that can fail creating hazards to per- sonnel and equipment.
Our units are designed for operation and maintenance by unskilled personnel in the harshest of desert or marine environments.
Our pumps and ERDs use bearings that are lubricated by feed or brine to eliminate the numerous maintenance and logistics issues associated with oil or grease lubricated bearing systems. FEDCO offers three material of construction: Duplex SS, Super Duplex SS and 316 SS.

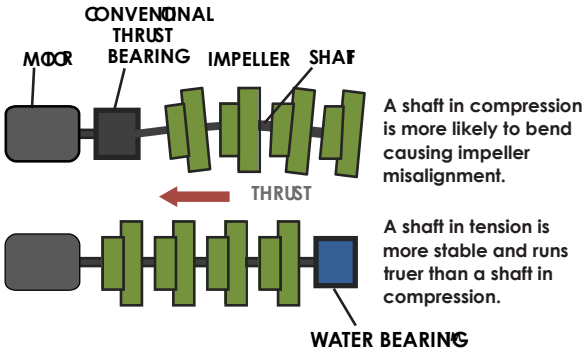
Our Technology
Years of continuous improvement driven by customer feed back have lead to key technical developments in FEDCO pumps and ERDs.

WATER BEARING™
The WATER BEARING™ eliminates virtually all pump bearing maintenance and numerous failure modes associated with

ai classici cuscinetti lubrificati con olio / grasso. WATER BEARING ™ assorbe gli alti livelli di pressione generati dalla pompa centrifuga, utilizzando un disco di bilanciamento integrato nello scarico della pompa. Il pompaggio (ad es. acqua di alimentazione) fornisce tutta la lubrificazione e il raffreddamento necessario. Inoltre, posizionando WATER BEARING ™ nello scarico, i carichi di pressione mettono in tensione l'albero della pompa. WATER BEARING ™ è di serie sulle linee di prodotti MSS, MSB, MSD, SSD e LP.



oil/grease lubricated bearing systems. The WATER BEARING™ absorbs the high levels of thrust generated by centrifugal pump operation by using a balance disc integrated into the discharge of the pump housing. The pumpage (e.g. feed water) provides all lubrication and cooling. Moreover, by locating the WATER BEARING™ in the pump discharge, thrust loads act to place the pump shaft in tension. The WATER BEARING™ is standard on the MSS, MSB, MSD, SSD, and LP product lines.



1 Assorbe tutta la spinta generata dal funzionamento della pompa - nessuna spinta al motore
2 Utilizza il pompaggio per raffreddare il cuscinetto - nessun limite di temperatura ambiente
3 Completamente alloggiato nel guscio della pompa - immune a polvere, sabbia e pietrisco
4 Lubrificato dal fluido in alimento: non necessita mai di lubrificazione
5 Manutenzione zero: fornisce anni di servizio ininterrotto
6 L' innovativo design, pone l'albero della pompa in una tensione ottimale, senza possibilità che l' albero risulti instabile
7 Di facile accesso - motore, accoppiamento e allineamento sgombri da ostacoli.

Lubrificazione ROTOR-FLO ™

Questa tecnologia in attesa di brevetto, fornisce una lubrificazione ottimale al cuscinetto reggispinta del rotore, utilizzando l' acqua in alimento come lubrificante. Il progetto è stato sviluppato per soddisfare lo start-up del sistema in cui le membrane, le testate dei vessels e le tubazioni, tendono a svuotarsi durante l' arresto. Durante l' avvio, ciò potrebbe causare una momentanea cavitazione della pompa con conseguente funzionamento a secco del cuscinetto. ROTOR-FLO ™ garantisce una lubrificazione completa al momento dell'avvio. Inoltre i canali di flusso, aumentano automaticamente la pressione del cuscinetto con l'aumentare della velocità del rotore (e del carico di spinta). ROTOR-FLO ™ elimina sia le linee che necessitano di una lubrificazione esterna che il numero di raccordi utilizzati (vedi prodotti concorrenti) garantendo la massima affidabilità e sicurezza. ROTOR-FLO ™ è di serie su tutti i modelli HPB e HP-HEMI.

Idraulica personalizzata

I canali di flusso idraulico in una macchina per fluidi, determinano la sua efficienza, le sue portate e le relative pressioni. Ogni modulo a turbina FEDCO HPB, SSD, HEMI e LP, è progettato secondo una geometria personalizzata, diffusori multi palette, turbina a spirale e ugelli comprensivi di anelli.
• I progetti vengono generati in sito entro poche ore dall'inserimento dell'ordine.
• Ogni unità FEDCO viene ottimizzata per le vostre esigenze - non viene considerato nessun progetto standard "a catalogo" che potrebbe ridurre le necessarie prestazioni idrauliche
• Consegne più rapide grazie al sofisticato software di FEDCO che progetta e produce i componenti ottimizzandone i tempi e consentendo rapide consegne dei kit per la manutenzione anche dopo anni dall' instalazione.

Analisi CFD

La Computazionale Fluido Dinamica (CFD) è diventato uno strumento avanzato nella progettazione di una pompa.
Tuttavia, per trasformare milioni di calcoli in pompe e turbine che funzionano secondo previsioni, ci vogliono anni di ricerca

1 Absorbs all thrust generated by pump operation - zero thrust to the motor
2 Uses pumpage to cool the bearing - no ambient temperature limit
3 Entirely housed within pump shell - immune to dust, sand and grit
4 Lubricated entirely by the feed - never needs lubrication
5 Zero maintenance - provides years of uninterrupted service
6 Unique layout places pump shaft in optimal tension - no potential for shaft buckling
7 Easy inpection - no disturbance to motor, coupling or alignment

ROTOR-FLO™ Lubrication

This patent-pending design provides optimal lubrication to the rotor thrust bearing using feed water as the lubricant. The design was developed to meet system startup procedures where membranes, headers and associated piping partially drain during shutdown.
This could result in momentary operation with a dry thrust bearing during start-up. The ROTOR-FLO™ design ensures full lubrication at the instant of start-up. More over, the radial flow channels, automatically increases bearing pressure as rotor speed (and thrust load) increases.
The ROTOR-FLO™ design is used in the HPB and HP-HEMI prod- uct lines. The ROTOR-FLO™ design eliminates external lubrication lines and fittings (used in competing units) thus ensuring maximum reliability and safety.
The ROTOR-FLO™ is standard on all HPB and HP-HEMI models.

Customized Hydraulic Design

The hydraulic flow channels in a fluid machine determines effi ciency, pressure generation and flow range. Every FEDCO HPB, SSD, HEMI, and LP turbine module is designed with customized impeller geometry, multi-vane diffusers, turbine volutes, and nozzle rings.
• Designs are generated on the shop floor within hours of order entry.
• Every FEDCO unit is optimized for your duty points - no compromises with "catalog" units with poorly matching hydraulic performance and reduced efficiency
• Faster delivery by FEDCO's sophisticated software-based design and manu-facturing process, no waiting for castings, no delays in overhaul kits even years after original installation.

CFD Analysis

Computational Fluid Dynamics (CFD) has become a standard tool in advanced pump design efforts.
Yet, to turn millions of calculations into pump and turbine hardware that perform as predicted takes years of focused re-

mirata, centinaia di accurati test idraulici e perfezionamento continuo dei parametri del CFD.

L'analisi CFD è una guida completa per la progettazione idraulica personalizzata di ogni pompa mega-HPB ERD e SSD. L'analisi CFD è calibra sul nostro software proprietario di progettazione idraulica e utilizzato per ogni prodotto FEDCO standard. Ogni unità FEDCO ha una base di progettazione CFD / test, frutto di perfezionamenti e anni di prove.

Produzione integrata

FEDCO ha sviluppato e perfezionato una tecnica produttiva integrata che converte le esigenze di flusso e pressione del committente, in progetti idraulici ottimizzati e quindi in programmi di lavorazione a Controllo Numerico Computerizzato (CNC) attivabili con la semplice pressione di un pulsante. I progetti ottenuti, diventano così i sistemi idraulici più avanzati ed ottiizzati presenti nel nostro mercato.

I programmi CNC e le relative istruzioni di lavoro, vengono inviati alle macchine di produzione tramite una rete di computer. Spesso, entro poche ore dall'inserimento dell'ordine, vengono prodotte pompe e turbine completamente personalizzate nelle leghe in acciaio inossidabile desiderate.

I componenti personalizzati, vengono monitorati attraverso il processo di produzione. Tutti i dati di test poi, vengono recepiti attraverso sistemi di acquisizione dati per poi essere salvati su appositi server.

Processi e Standard Produttivi

• Certificazione ISO-9001: 2015 - FEDCO è certificata e registrata.

• Certificazione ISO-14001: 2015 - FEDCO è certificata e registrata.

• Marchio CE: disponibile sulla maggior parte dei prodotti FEDCO

• Certificazione NSF in ciclo continuo - Le linee di produzione delle pompe centrifughe, hanno ricevuto la certificazione NSF in conformità agli standard di prova dell'Istituto Idraulico.

Oltre al software CFD, FEDCO utilizza una vasta gamma di software di progettazione e analisi tra cui:

• Analisi dei componenti finiti (FEA) per verificare i fattori di sicurezza e i loro livelli generali di sollecitazione / deformazione

• Analisi di solidificazione della fusione (CSA) per ottimizzare i nuovi progetti di fusione e ridurre al minimo il rischio di difettosità come la porosità e il restringimento

• SolidWorks 3-D Computer Aided Design (CAD)

• Una vasta gamma di software proprietari per la progettazione e la produzione

Test del prodotto

Mettendo insieme progetti analitici, sviluppo di prototipi e test di produzione, i cinque (5) cicli di test di FEDCO, assicurano prestazioni che soddisfano o superano le aspettative dei clienti. Gli attuali test di produzione includono sistemi impiagati su acqua di mare fino a 2.500 kW, su acqua salmastra e turbine per il recuero energetico. FEDCO testa il 100% di tutte le unità produttive.

I test di produzione sono certificati NSF per soddisfare gli standard dell'Istituto Idraulico riguardante i test sulle pompe centrifughe.

search, hundreds of accurate hydraulic tests and continuous refi nement of the CFD model parameters.

Comprehensive CFD analysis guides the custom design of all hydraulic passages for every mega-HPB ERD and SSD pump. CFD analysis calibrates our proprietary hydraulic design software used for every FEDCO standard product. There is a CFD/testing design basis for every FEDCO unit, backed by years of testing and refinement.

Integrated Manufacturing Operations

FEDCO developed and continuously refi nes an integrated manufacturing operation that converts customer fl ow and pressure requirements into optimized hydraulic designs and then into Computer Numerical Control (CNC) maching programs with little more than a push of a button. The resulting designs represent the most advanced hydraulic designs and machining optimization in our market.

The CNC programs and work instructions are sent to the manufacturing machines via a computer network. Often, within hours of order entry, fully customized and optimized pumps and turbines are being manufactured from the specifi ed stainless steel alloys.

Customized components are tracked through the manufacturing process. All test data is acquired through data acquisition systems with results saved on data servers.

Standards and Processes

• ISO-9001:2015 Certifi cation - FEDCO is certified and registered.

• ISO-14001:2015 Certifi cation - FEDCO is certified and registered.

• CE Mark - Available on most FEDCO product lines

• NSF test loop certification - Large production test loops have received NSF certification for compliance with Hydraulic Institute test standards for centrifugal pumps.

In addition to CFD software, FEDCO utilizes a wide variety of design and analytical software including:

• Finite Element Analysis (FEA) to verify safety factors and general stress/strain levels

• Casting Solidifi cation Analysis (CSA) to optimize new casting designs to minimize the potential for casting defects such as porosity and shrinkage

• SolidWorks 3-D Computer Aided Design (CAD)

• A large collection of proprietary design and manufacturing software

Product Testing

Tying together analytical designs, prototype development and production testing, FEDCO's five (5) test loops ensure performance that meets or exceeds the customer's expectations. Current production test loops include mega-scale seawater systems up to 2,500 kW, brackish water testing, and power recovery turbines. FEDCO tests 100% of all production units.

Production test loops are certifi ed by NSF to meet Hydraulic Institute Standards for centrifugal pump testing.

PANORAMICA PRODOTTI/ PRODUCT OVERVIEW

Standard Product Line

MSS SERIES HP FEED PUMP

- 7.5 - 295 m³/h (33 - 1300 gpm) and pressures to 83 bar (1200 psi)

MSD SERIES HP FEED PUMP

- 20 - 560 m³/h (88 - 2465 gpm) and pressures to 83 bar (1200 psi)
- All Super Duplex SS construction

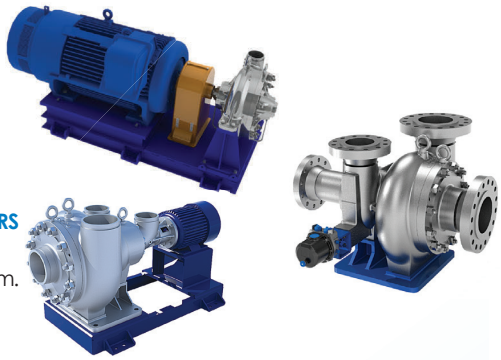
HYDRAULIC PRESSURE BOOSTER (HPB) ENERGY RECOVERY TURBINE

- 10 - 3200 m³/h (30 - 14000 gpm)
- Pressures to 83 barg (1200 psig) with option up to 110 bar
- Constructed in Duplex SS 2205 or Super Duplex 2507

MSMT - MULTI STAGE MULTI TURBOCHARGER

- Recover up to 60% in SWRO
- Savings up to 20% in Total Water Cost (CAPEX+OPEX)

Mega System Products



SSD SERIES HP FEED PUMP

Single stage HP feed pumps for SWRO service

- 450-650 m³/h (1931-2861 gpm)
- Pressures to 35 barg (500 psig) and 68 bar (1000+ psig with HPB or HP-HEMI)
- Direct drive - 3500 RPM or 2900 RPM nominal speed

HP-HEMI AND HPB ENERGY RECOVERY TURBINE/MOTORIZED TURBOCHARGERS

Obtain total control of your membrane operating conditions with **FEDCO**'s Hydraulic Energy Management Integration (HEMI) for SWRO system.

- 400-3200 m³/h (14000 gpm)
- Pressures to 83 barg (1200 psig)

Brackish Water/Low Pressure Products

SLP SERIES PUMP

- 30 to 850 gpm (6.8 to 193 m³/h) and pressures from 35 to 130.5 psi (2.4 to 9 bar)
- Super Duplex SS construction

MSB SERIES FEED PUMP

- 45 - 132 m³/h (198 - 581 gpm) and pressures to 35 bar (500 psi)
- 316 SS construction

LPH, LPS, LPD INTEGRATED PUMP AND ENERGY RECOVERY TURBINE MOTORIZED TURBOCHARGERS

FEDCO brings affordable energy recovery to low pressure RO systems.

- 30 - 300 m³/h (130 - 1320 gpm) brine flow
- 80 - 750 m³/h (350 - 3300 gpm) feed flow
- Pressures from 6 - 35 barg (87 - 500 psig)
- 316 SS construction

MSB-T SERIES PUMP WITH ENERGY RECOVERY TURBINE

- 7.5 - 132 m³/h (33 - 581 gpm) and pressures to 35 bar (500 psi)
- 316 SS construction

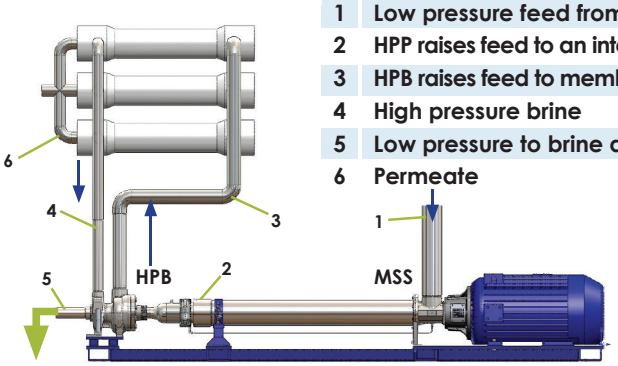
RETROFITS

Parts & Field Service

Life Cycle Cost Analysis

Standard Products - MSS and MSD Feed Pumps with HPB

- Thousands of units in SWRO Service
- RO Feed Pumps with Energy Recovery Pressure Boosters
- Feed flows from 7.5 to 560[3] m/h
- Pressures to 83 bar (optional to 110 bar on some models)



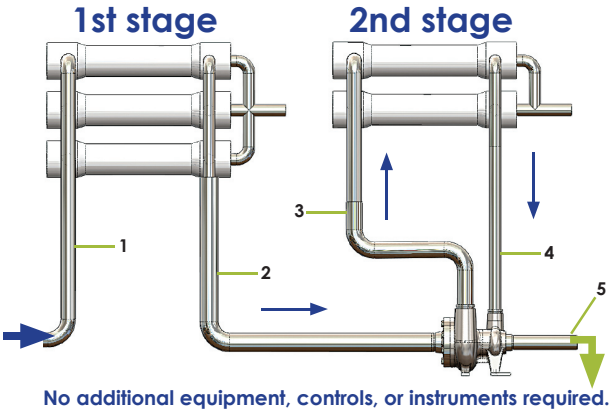
1	Low pressure feed from pretreatment
2	HPP raises feed to an intermediate pressure
3	HPB raises feed to membrane requirements
4	High pressure brine
5	Low pressure to brine drain
6	Permeate

No additional equipment, controls, or instruments required.

FEED BOOSTER CONFIGURATION

Simply start the pretretment system, flush air from the membranes, start the HP pump and startup is complete. Adjust feed and brine flow for desired recovery.

HPB shown mounted on optional extended pump base plate. HPB may also be located anywhere in the RO system to minimize piping runs.



1	High pressure feed from HPP
2	1st stage brine
3	HPB raises feed to 2nd stage requirements
4	High pressure brine
5	Low pressure to brine drain

No additional equipment, controls, or instruments required.

INTERSTAGE BOOSTER CONFIGURATION

Interstage boosting balances flux rates, improves permeate quality and overall production. With optimized array design, interstage boosting can provide exceptionally low energy consumption.

Hydraulic Coverage

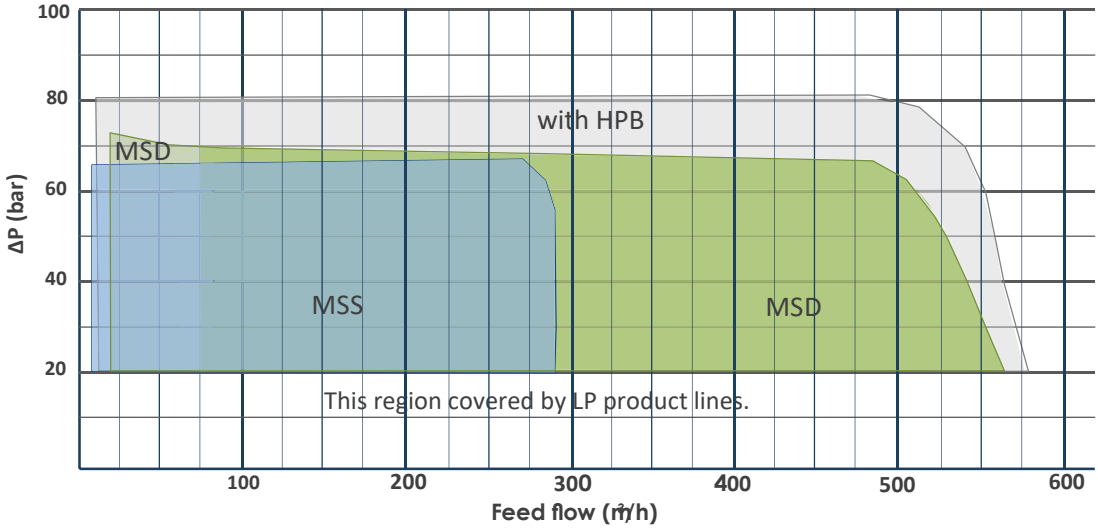


*Chart displays typical range of coverage.

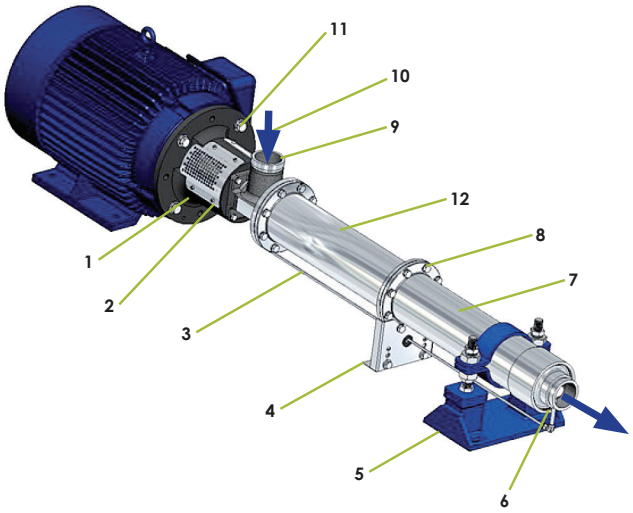
MSS Series Feed Pumps

The MSS series multi-stage centrifugal high pressure feed pumps have proved to be the most reliable high pressure feed pump available today.

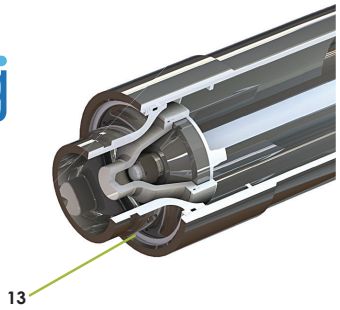
Loaded with unique features such as the patented WATER BEARING™ thrust bearing, pumpage-lubricated shaft bearings and maintenance-free design ensure years of trouble-free operation.

Models

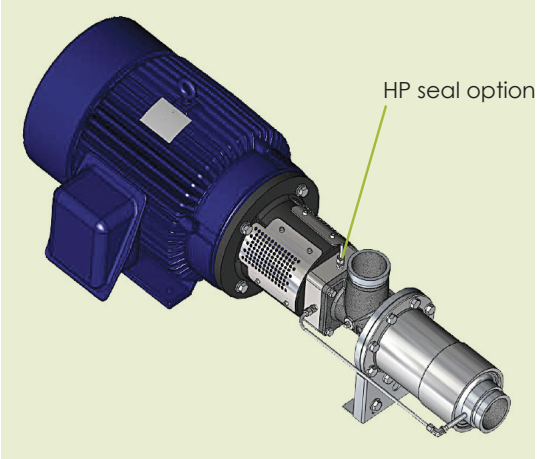
MSS-15
MSS-20
MSS-30
MSS-40
MSS-55
MSS-75
MSS-90
MSS-120
MSS-160
MSS-200
MSS-240



PATENTED water bearing TECHNOLOGY



High Inlet Pressure Option



All MSS pumps can be equipped with a high inlet pressure option to allow inlet pressures to 70 barg. The unique design features:

- Use of low cost, standard mechanical seals operating at low pressure (1-2 bars typical)
- Total protection of the motor from pump thrust loads - a major problem with high inlet pressure operation.

1	Shaft seal operates at low pressure
2	Flexible disc coupling
3	Bearing drain line (low pressure)
4	316 SS shell support bracket
5	Precision leveling foot
6	Victaulic pipe joints
7	Duplex SS 2205 housing
8	Flanged construction for easy internal inspection
9	Inlet rotatable in 90° increments
10	Easy shaft alignment
11	ntegrated motor adapter (anodized aluminum alloy)
12	316L SS stages – passivated & electropolished – proven in hundreds of SWRO applications
13	WATER BEARING™

MSD Series Feed Pumps

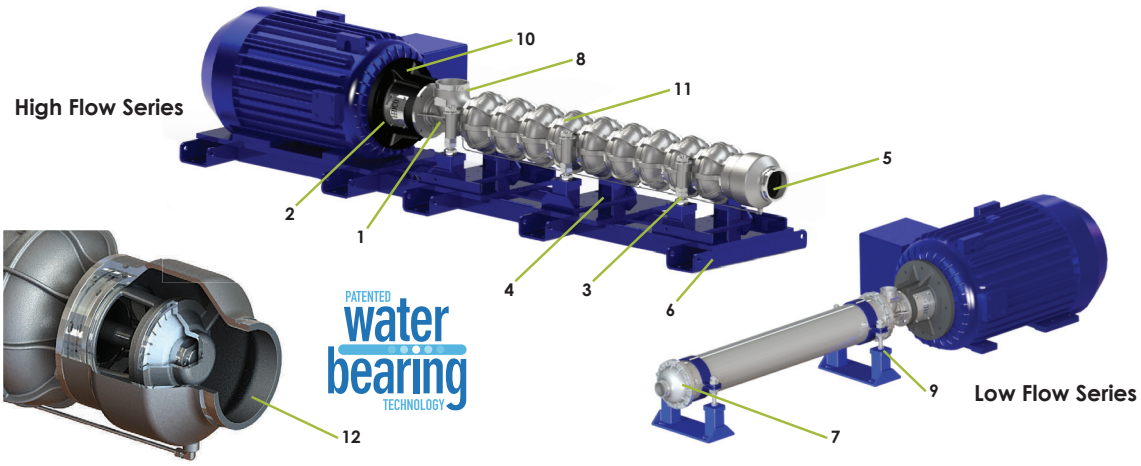
Models

MSD-40
MSD-70
MSD-130
MSD-160
MSD-200
MSD-270
MSD-350
MSD-400

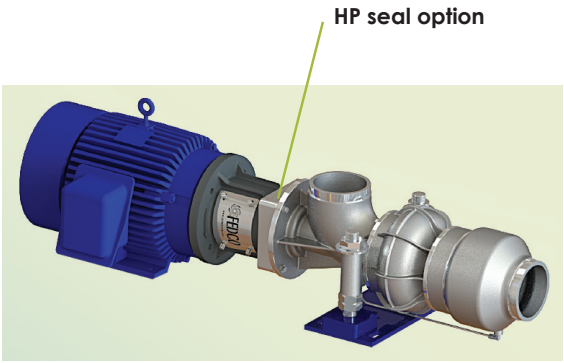
Coming soon!
MSD-650
MSD-850
in development

The MSD series multi-stage centrifugal high pressure feed pumps provide a new level of reliability and efficiency in SWRO pumps.

Loaded with unique features such as the patented WATER BEARING™ thrust bearing, all Duplex SS construction, product lubricated bearings and maintenance-free design ensure years of trouble-free operation. The MSD series is all Super Duplex SS 2507 with precision investment cast stages and impellers.



High Inlet Pressure Option



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- Useof low ost, standard mechanical seals operating at low pressure (1-2 bars typical)
- Total protection of the motor from pump thrust loads - a major problem with high inlet pressure operation.

1	Shaft seal operates at low pressure
2	Flexible disc coupling
3	Bearing drain line (low pressure)
4	Stage support blocks
5	Victaulic pipe joints
6	Baseplate
7	Flanged construction for easy internal inspection
8	Inlet rotatable in 90° increments
9	Easy shaft alignment
10	Integrated motor adapter (anodized aluminum alloy)
11	Super Duplex SS 2507
12	WATER BEARING™

Hydraulic Pressure Boosters (HPB) The World's Most Effi cient Turbine Based ERD

Performance and Reliability

FEDCO leads the industry in turbocharger efficiency as the fi rst and only company to exceed 80% transfer efficiency. The same technology used in our record-setting units is used throughout our entire HPB product line.

Superior effi ciency comes with superior reliability as **FEDCO** offers the industry-leading three (3) year limited warranty on the entire HPB product line. Our high quality design includes:

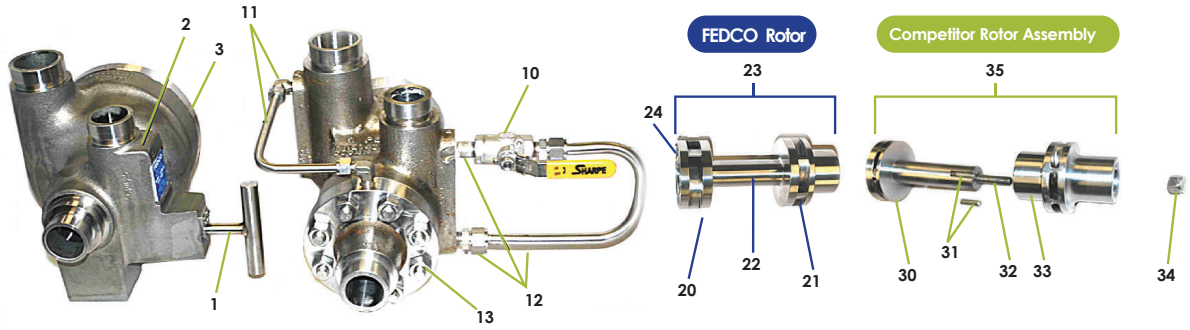
- elimination of all external tubing and valves
- one-piece rotor construction
- multi-vane diffuser
- rotor-flo thrust bearingplubricati

and many other features make the HPB the first choice for reliability.

Efficiency

Whether it is field operating log sheet data or precision test stand data, the HPB displays the highest average efficiency of any turbocharger ERD. Fully machined rotors, and CFD optimized hydraulic design makes the difference.

Why HPB has the longest warranty in the industry:



FEDCO

1	Integrated multi-turbine brine nozzle
2	Integrated brine nozzle flow channel
3	Single end cap designs for simplicity and machining accuracy
20	Turbine impeller vanes custom-machined from bar stock
21	Pump impeller vanes custom-machined from bar stock
22	Rotor is single-piece for rigidity and perfect balance for smooth operation
23	100% Duplex SS 2205 or Super Duplex SS 2507 construction. Dynamically balanced
24	Patent-pending rotor-flo bearing lubrication allows dry turbine running and greater bearing life

Competitor

10	1/4 turn ball valve for brine control (316 SS)
11	External HP feed line for bearing lubrication (316SS). Threaded connections and tube fittings creat failure points
12	External HP brine line (316 SS). Threaded connections and tube fi ttings create failure potential.
13	Dual end caps increase complexity and reduce manufacturing accuracy due to multiple setups in machining operations
30	Turbine impeller and shaft from castings — porosity & shrinkage reduce strength
31	Key and keyway creates looseness and lack of rigidity (316 SS)
32	Stud used to retain pump impeller against high thrust loads. Prone to failure(316 SS)
34	Retaining nut and stud (32) keeps impeller on shaft shoulder against high thrust loads (316 SS). Stud breakage is a catastrophic failure.
35	Rotor assembly cannot maintain dynamic balance due to need to disassemble during installation. Rotor is less rigid abd uses 316 SS in highly stressed components
36	SAFETY ISSUES - 316 SS tubing and fittings will fail from corrosion and vibration resulting in a potentially catastrophic high pressure spray of feed and brine

HPB Hydraulic Pressure Booster

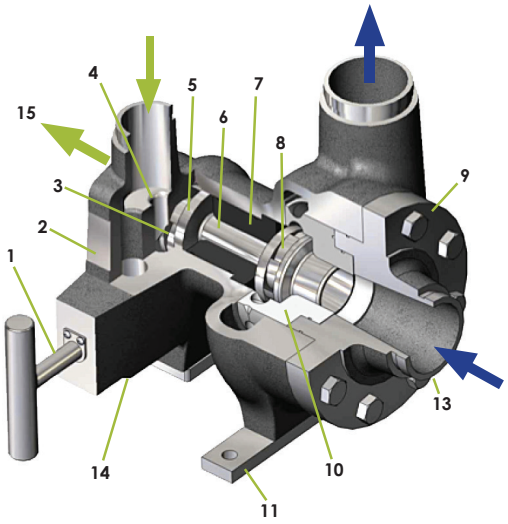
ERD Series Features

With ten (10) models, there is a perfect fi t for your most demanding performance, reliability and project schedule requirements. Standard MOC is Duplex SS 2205, however, Super Duplex SS 2507 is optional. Brine nozzle valve actuators, fl anged connections and other options available. Delivery of the standard line HPBs are built to your flows and pressures specifications in three (3) to (6) weeks in Duplex SS 2205.

1	Variable area in nozzle (needle type for precise control)
2	Nameplate
3	Thrust bearing - patent pending design, allows dry running
4	Brine nozzle and volute - custom designed and machined
5	Brine (turbine) impeller - custom designed and machined
6	Rotor shaft - integral with impellers (no keys, studs, washers, etc.)
7	Center bearing lubricated by feed - ZERO brine leakage to feed
8	Feed (pump) impeller - custom designed and machined
9	End cap
10	Multi-vane diffuser - custom designed and machined to ensure radial pressure balance for long wear ring and bearing life, provides higher efficiency than volutes
11	Mounting foot (varies by model)
12	O-rings - all bearings mounted on o-rings for easy removal
13	Victaulic-type pipe joints (flanged joint optional)
14	Standard Duplex SS 2205 MOC (Super Duplex SS 2507 optional)
15	Can discharge brine at higher pressure for easy brine disposal

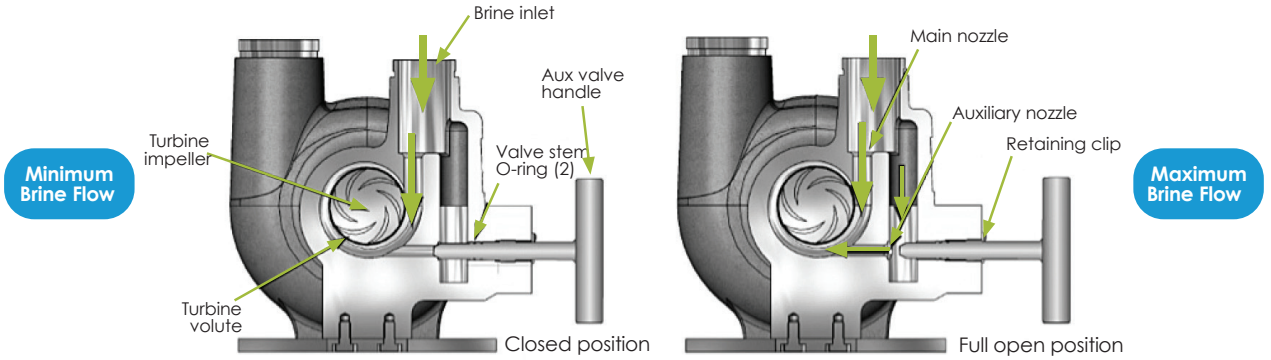
Models

HPB-10
HPB-20
HPB-30
HPB-40
HPB-60
HPB-80
HPB-90
HPB-130
HPB-180
HPB-250
HPB-350



Brine Flow Regulation

Brine fl ow adjustment is accomplished by simply turning the aux nozzle handle. Open to increase brine fl ow and close to reduce brine fl ow.
Note that the multi-turn needle valve provides precise flow regulation.
Note that brine is not bypassed when the nozzle is open - all brine flow passes through the turbine impeller to maximize energy recovery.



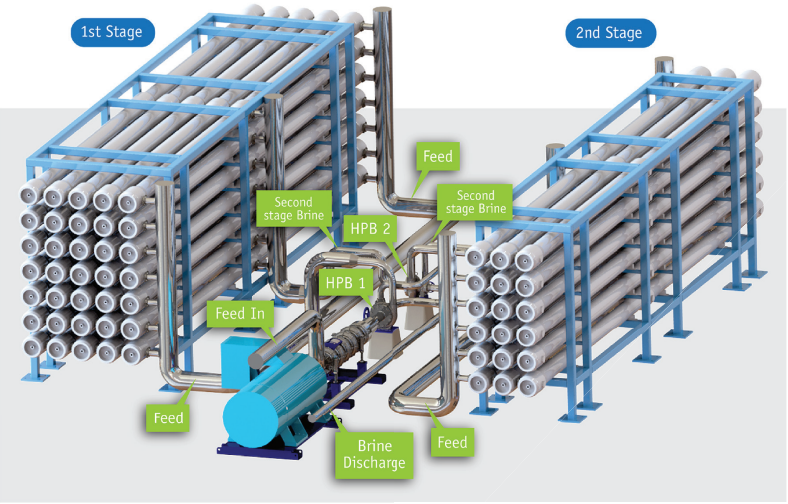
Multi Stage Multi Turbocharger (MSMT)

- Recover up to 60 % in SWRO
- Savings up to 20% in Total Water Cost (CAPEX+OPEX)
- Reduction of up to 33% in pretreatment size
- Application from small to mega-scale projects

MAXIMIZE EFFICIENCY & RECOVERY

High Recovery creates savings:

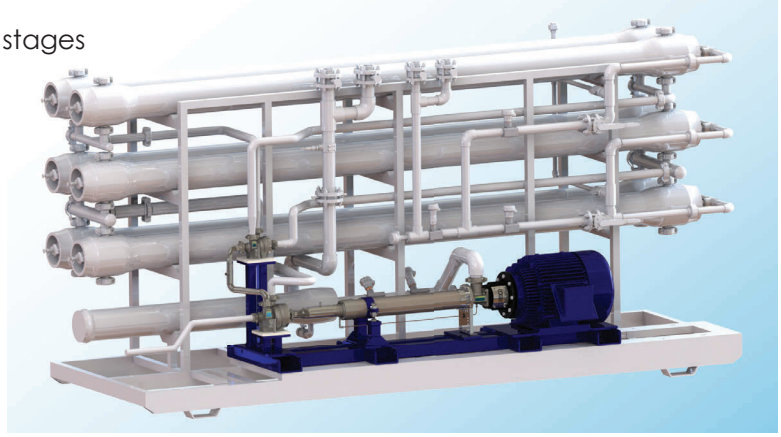
- Competitive SEC
- Reduced intake costs
- Reduced brine discharge/outfall costs
- Reduced pipe and valve sizes
- Reduction in pretreatment equipment size
- Maintenance parts costs
- Footprint (civil works)
- Lead times - due to smaller size of equipment, piping, footprint
- Chemical consumptions (greener process)



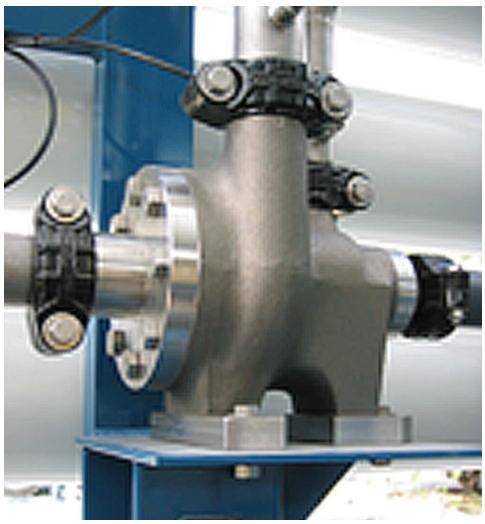
Pilot courtesy Water Technologies de Mexico - 2019

Membrane performance benefits:

- Reduced fouling potential
- Highly improved flux balance between stages
- Reduction of lead flux
- Increase on tail element flux



Typical MSS Pump and HPB Standard Package Installations

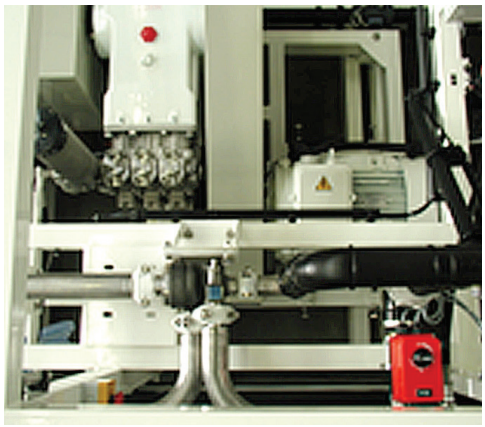


HPB 40

MSS and HPB in a container

MSD and HPB common baseplate

MSMT installation

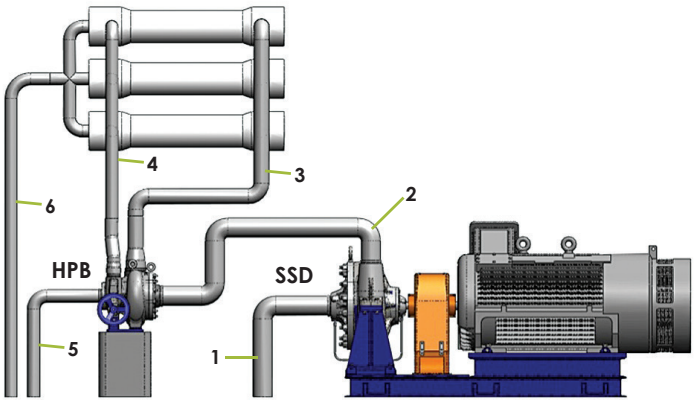


HPB with reciprocating HPP

MSS and FEDCO baseplate

Mega Products - SSD and HPB or HP-HEMI

- RO High Pressure Feed Pumps (HPP) with Energy Recovery Hydraulic Pressure Boosters
- Feed Flows from 400 to 650m³/h
- Pressure to 83 bar

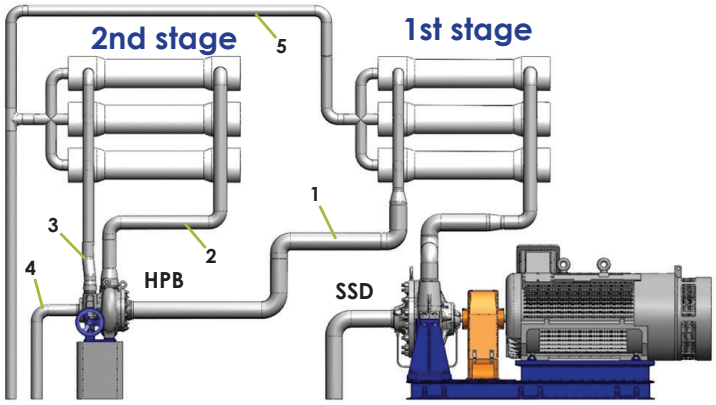


No additional equipment, controls, or instruments required.

1	Low pressure feed from pretreatment
2	HPP raises feed to an intermediate pressure
3	HPB raises feed to membrane requirements
4	Low pressure to brine drain
5	Premeate

FEED BOOSTING CONFIGURATION
THE HPB may be located anywhere in the system to minimize piping costs.

HPP is sized to handle feed fl ow at reduced pressure differential.

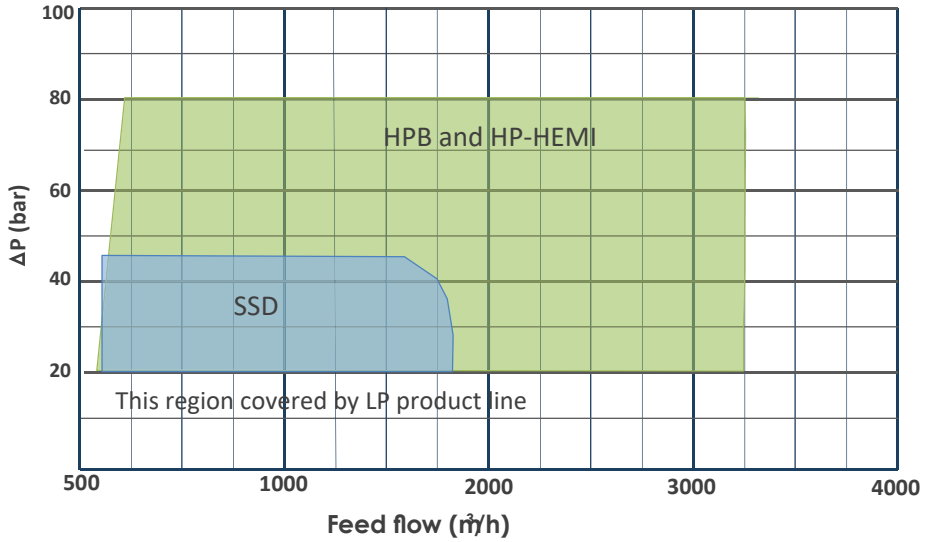


No additional equipment, controls, or instruments required.

1	1st stage Brine
2	Boosted pressure to 2nd stage
3	2nd stage brine to HPB
4	Low pressure to brine drain
5	Premeate

INTERSTAGE BOOSTING CONFIGURATION WITH THE HPB
Interstage boosting balances flux rates, improves permeate quality and overall production. With optimized array design, interstage boosting can provide energy effi ciency as good as any other type of ERD - often at a lower capital cost.

Hydraulic Coverage



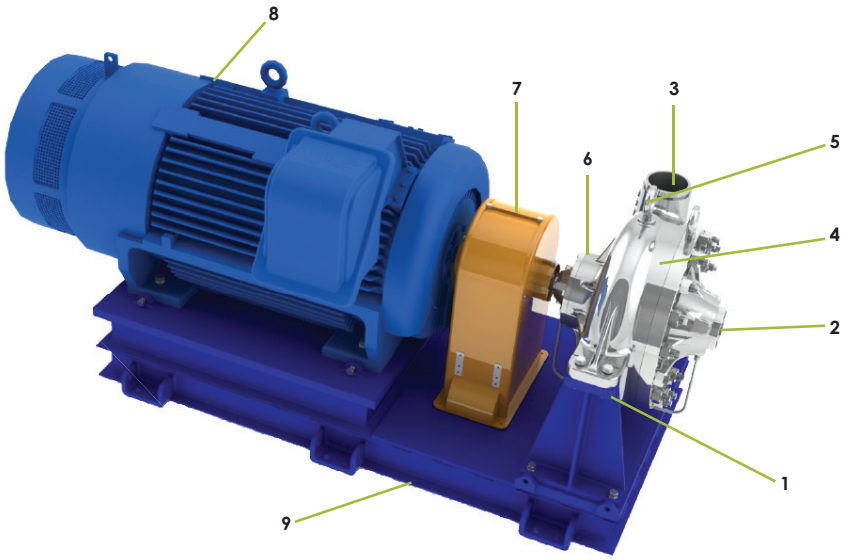
Mega Systems SSD Series Feed Pump

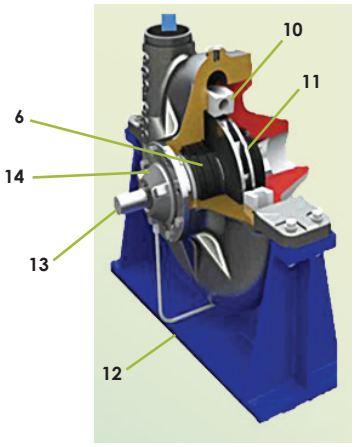
The SSD series single-stage centrifugal high pressure pump (HPP) performs just like any heavy-duty SWRO feed pump; but, at higher efficiency and lower capital cost. And, with faster delivery it is ideal for the most demanding project schedule. The SSD series can reach pressures of 83 bar (1200 psi) when used with the HPB or HP-HEMI energy recovery devices. The direct drive motor can be a 50 or 60 Hz, 2-pole motor with speed of 2900 RPM to 3500 RPM.

Models

SSD-500

Our mega system SSD feed pump is supplied in Duplex SS 2205 or the option of Super Duplex SS 2507. A one-piece shaft is machined from bar stock. The single-stage design provides a small footprint. The SSD series use pumpage-lubricated bearings for maintenance free operation.





1	Centerline mount
2	Feed inlet
3	Feed outlet
4	Duplex SS 2205 (optional Super Duplex SS 2507)
5	Pump-lifting eye-bolt
6	Pumpage-lubricated bearings
7	Coupling guard
8	50 or 60 Hz 2-pole motor
9	Common base plate
10	Diffuser ring-custom machined
11	Impeller-custom machined
12	Seal flush line
13	Shaft
14	Shaft seal

Designed Specifically for RO Service

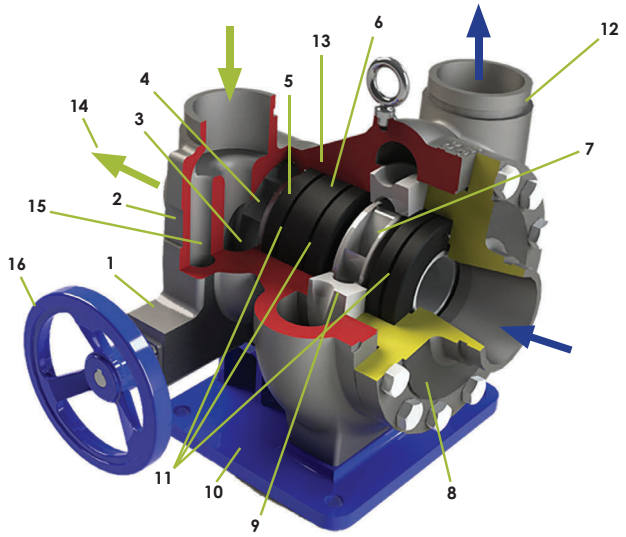
- DP range up to 44 bar
- Available in Duplex SS 2205 or Duplex SS 2507
- Optimized for typical NPSHA in SWRO systems
- Every aspect of design and manufacture aimed at maximum possible efficiency

Mega System HPB Design and Construction

Six (6) models cover the largest current and anticipated SWRO trains. Standard MOC is Duplex SS 2205 with Super Duplex SS 2507 optional. Brine nozzle valve actuators, flanged connections and other options available.

Models

HPB-500 HPB-1400
HPB-700 HPB-2000
HPB-1000 HPB-2800



1	Brine aux nozzle valve (needle type for precise control)
2	Nameplate
3	Thrust bearing — patent pending design, allows dry running
4	Brine (turbine) impeller — custom designed and machined
5	Rotor shaft — integral with impellers (hidden in this view)
6	Center bearing — lubricated by feed, ZERO brine leakage to feed
7	Feed (pump) impeller , custom designed and machined
8	End cap
9	Multi-vane diffuser — customer designed and machined to ensure radial pressure balance for long wear ring and bearing life, provides higher efficiency than volutes
10	Baseplate
11	O-rings — all bearings mounted on o-rings for easy removal
12	Victaulic-type pipe joints (flanged joints optional)
13	Standard Duplex SS 2205 MOC, Optional Super Duplex SS 2507
14	Can discharge brine at high pressure for easy brine disposal
15	Integral brine passage for auxiliary turbine nozzle
16	Hand wheel, optional valve actuator, for brine flow regulation

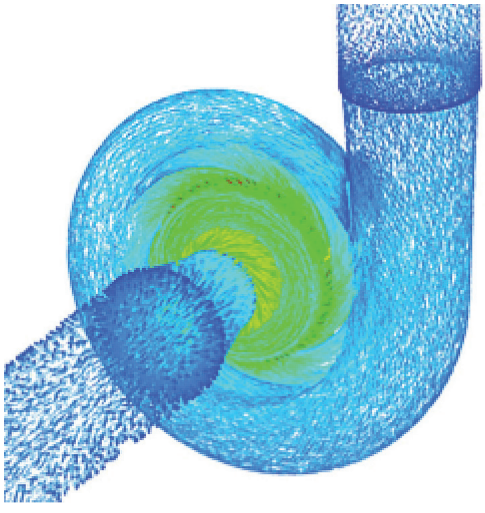
Hundreds of Tests, Years of CFD Analysis Yields Record-Setting Efficiency

The HPB is the first and only turbocharger to achieve 80+% transfer efficiency. CFD (Computational Fluid Dynamics) runs involving trillions of calculations helped to optimize every inch of the flow passages.

Proprietary software converted the CFD designs into CNC (Computer Numerical Control) programs to turn Duplex SS or Super Duplex SS plate into ultra-smooth and hydraulically optimal feed and brine channels.

Patent-pending bearing systems ensure reliable operation with minimal bearing losses.

Record setting HPB-1400 displays 80+% transfer efficiency



Visualization of flow data from a CFD analysis

Hydraulic Energy Management Integration (HP-HEMI)

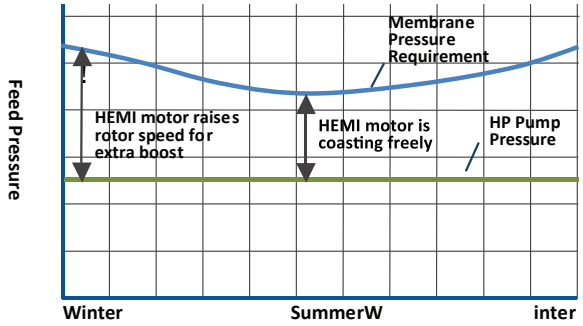
- Feed flows from 400 to 3200 m^3/h
- Pressures to 83 bar

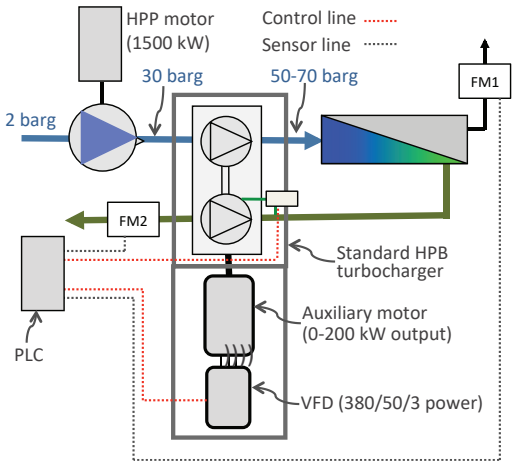
Every SWRO system must be able to supply a varying pr essure to the membrane array to accommodate changes in feed temperature, salinity and membrane fouling. The up-per curve in the adjacent graph illustrates a typical annual membrane pressure variation.

However, centrifugal HPPs cannot provide a variable discharge pressure without use of a very expensive and failure-prone medium/high voltage variable frequency drive (VFD). In addition, the VFD imposes a 3% energy loss.
The HPP operating at constant flow and speed produces a constant discharge pressure as depicted by the green line. The function of the HEMI is to bridge the gap between the HPP constant-pressure characteristic and the membrane variable pressure requirement.

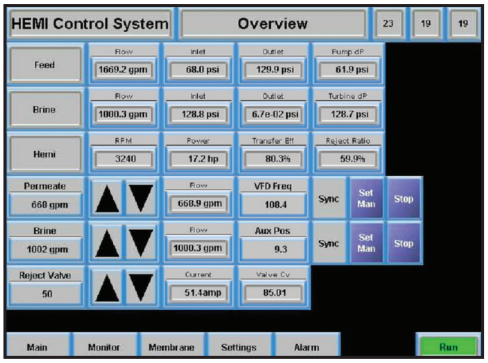
The HEMI is a modified HPB with a motor attached to its rotor. As illustrated by the adjacent figure, the motor may be 200 kW and is driven by a standard low voltage VFD. The HPP motor may be 1500 kW and may be a direct start. In this example, the HPP delivers a constant 30 barg discharge pressure while the membrane pressure varies between 50 and 70 barg. At low membrane pressure conditions, the entire energy required for the 20 bar boost is provided by the HPB's turbine section. At the maximum boost of 40 bar, the turbine provides most of the power while the motor provides the balance.

The HEMI can provide entire SWRO control of feed and brine flows by the addition of a basic PLC. The permeate flow meter (FM1) controls the HEMI VFD and the brine flow meter controls the HPB turbine variable nozzle via signals from the PLC. The basic control philosophy is illustrated in the adjacent table.

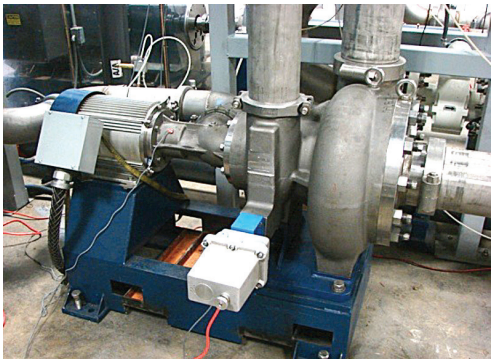




Permeate flow too high	HEMI VFD reduces rotor speed (reduces feed boost)
Permeate flow too low	HEMI VFD increases rotor speed (increases feed boost)
Brine flow too high	Turbinenozzle area reduced (reduces brine flow)
Brine flow too low	Turbine nozzle area increased (increases brine flow)



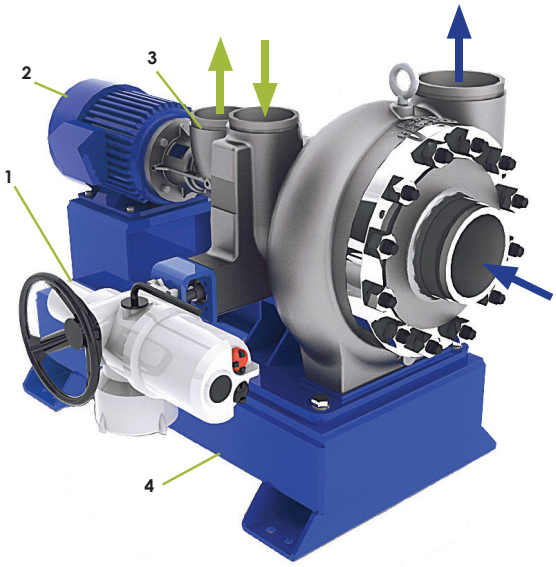
Typical HEMI PLC Display



HP-HEMI-1000

Mega System High Pressure Hydraulic Energy Management Integration (HP-HEMI)

Six (6) models cover the large st current and anticipated SWRO trains. Standard MOC is Duplex SS 2205 with Super Duplex SS 2507 optional. Brine nozzle valve actuators, flanged connections and other options available. **FEDCO** provides the complete HEMI package including motor, VFD and valve actuator.

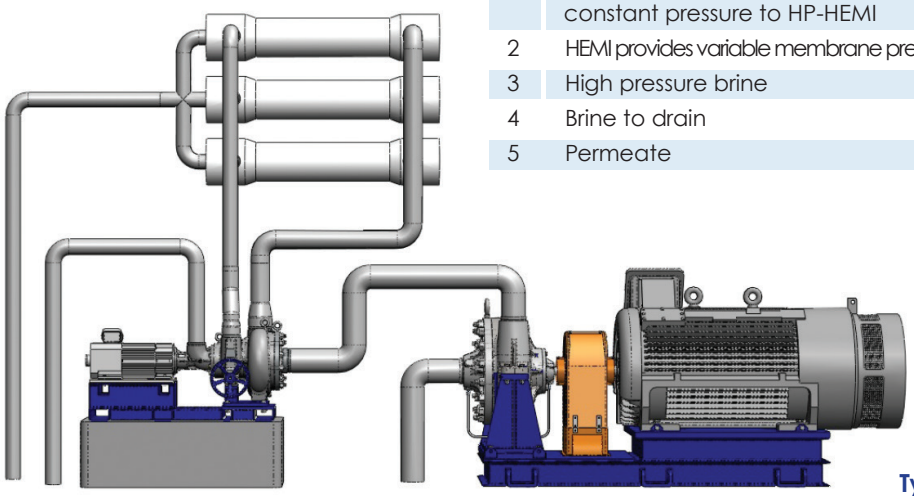


1	Brine aux nozzle actuator
2	HEMI motor
3	Brine discharge module
4	Common baseplate

HP-HEMI System for SWRO

The HEMI control can be integrated into the plant SCADA or **FEDCO** can provide a stand-alone PLC. Requiring only two process signals, permeate and brine fl ow, the HEMI control system is easy to install and operation is simple and intuitive.

1	SSD high pressure feed pump provides constant pressure to HP-HEMI
2	HEMI provides variable membrane pressure
3	High pressure brine
4	Brine to drain
5	Permeate



HP-HEMI

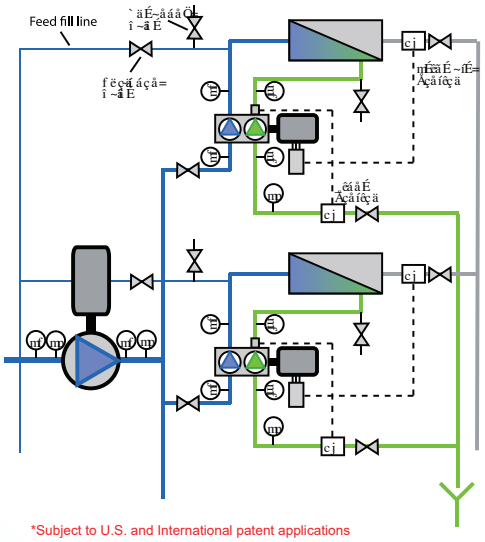
SSD Feed Pump

Typical low voltage VFD and PLC for the HP-HEMI

Mega Systems Design Options

FEDCO research into the basic hydraulic response of RO systems operating with variable membrane conditions has lead to two new plant designs that maximize energy efficiency, simplifies control, and minimizes capital costs.

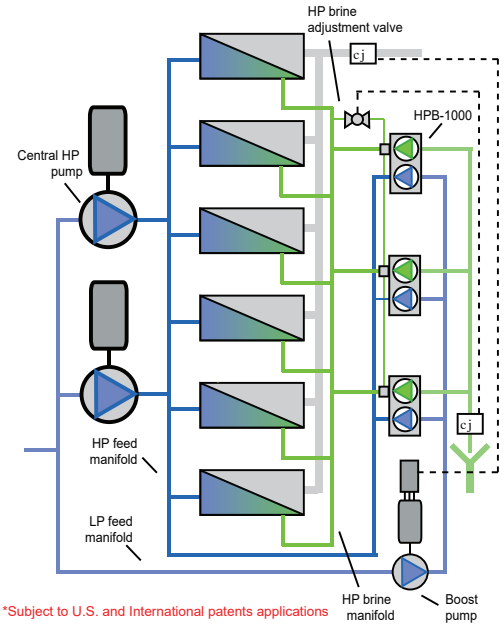
Hybrid Centralization



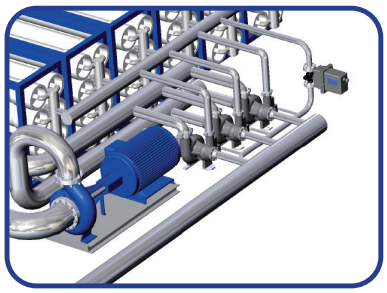
*Subject to U.S. and International patent applications

Hybrid centralization combines the benefits of centralized feed pumping and discrete RO train control. This design permits dynamic addition and removal of trains without interruption of production. The control scheme is simple and permits optimization of membrane conditions on a train-by-train basis.

Three-Center



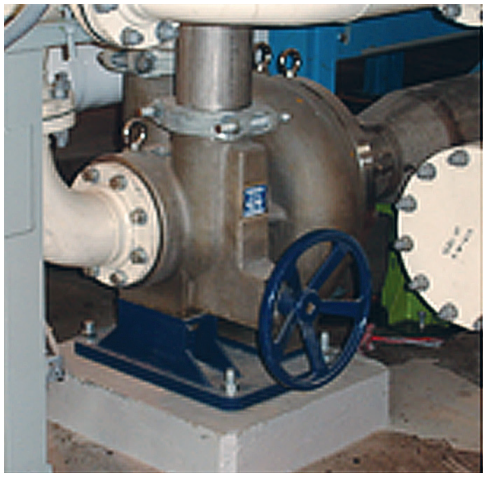
*Subject to U.S. and International patents applications



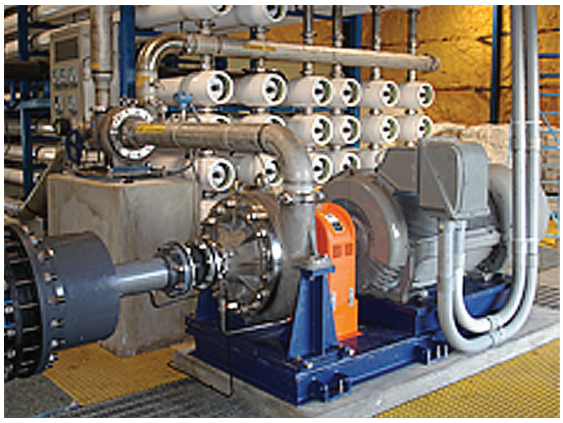
The HPB is ideal for three-center design by providing a large capital cost savings, simple control schemes and low specific energy consumption.

Typical Mega System Installations

HPB-700 (retrofit of competitors unit)

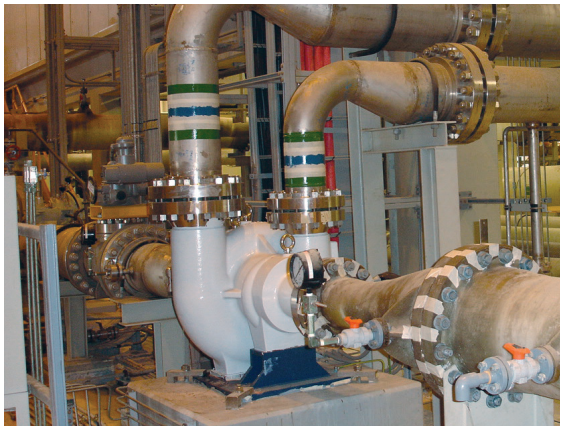


HPB-1000 in Jeddah, Saudi Arabia



SSD-500 with HPB-5000 SWRO Facility

SWRO train with HPB at lower right



HPB-1400 SWRO - Saudi Arabia

HPB-2800 installation SWRO - Saudi Arabia

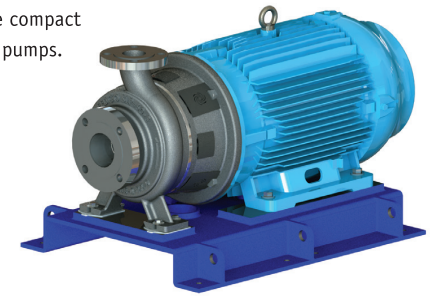
SLP Series Pump

Model

SLP-15
SLP-30
SLP-60
SLP-90
SLP-160

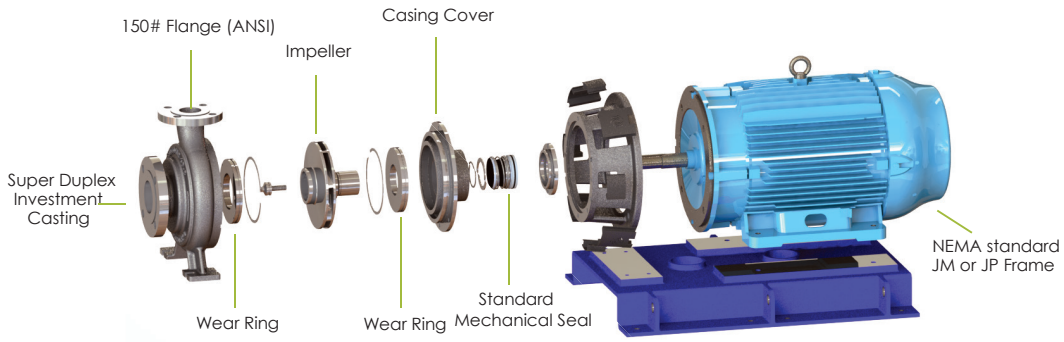
- High efficiency
- Super Duplex material of construction
- Capacity from 30 to 850 gpm (6.8 to 193 m^3/h)
- Heads up to 167 ft (51m)
- Pressures 35 to 130.5 psi (2.4 to 9 bar)

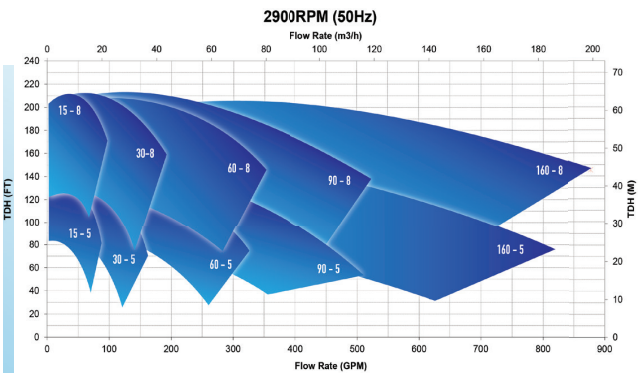
The SLP pump series is a low pressure end suction, close-coupled horizontal pump for general water process applications. It was designed with high efficiency and Super Duplex stainless steel construction for reliability and longevity in harsh environments. This pump series features a standard mechanical seal with seal flush to ensure long life, centerline discharge, self-venting design and no oil or grease lubrication for simple installation and maintenance.
The SLP is offered in five ANSI 150lb flanged models with a set of customizable impellers, coupled with a NEMA standard TEFC, JM or JP motor frame mounted on a commae compact footprint and robust construction gives the SLP series a superior advantagr pumps.

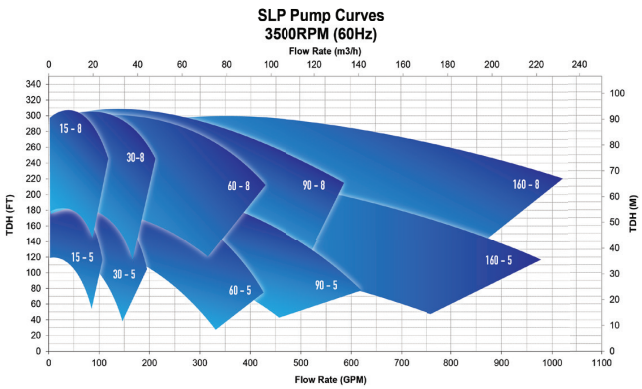


Applications:

- Reverse Osmosis
- Pretreatment
- Backwash
- Permeate Transfer







MSB Series Feed Pumps

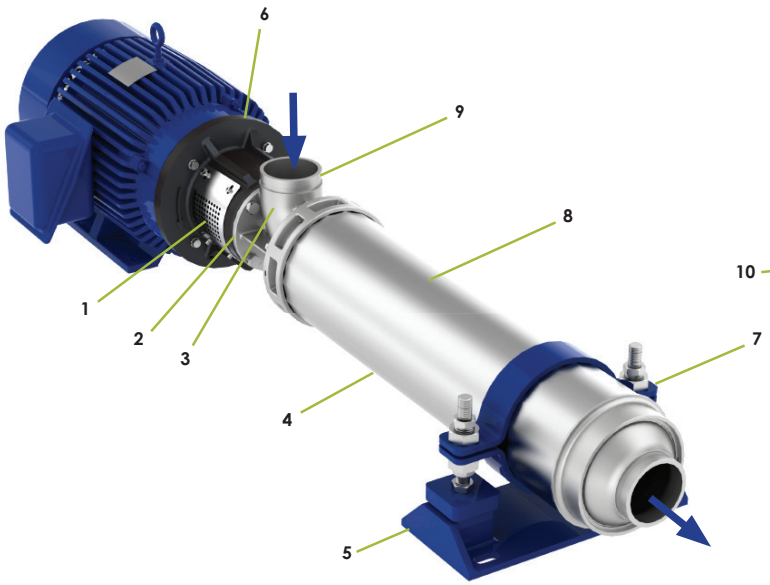
- Brackish/Low Pressure RO Feed Pump
- Feed flows from 45 to 132 m³/h (200 to 580 gpm)
- Pressures to 35 bar (500 psi)

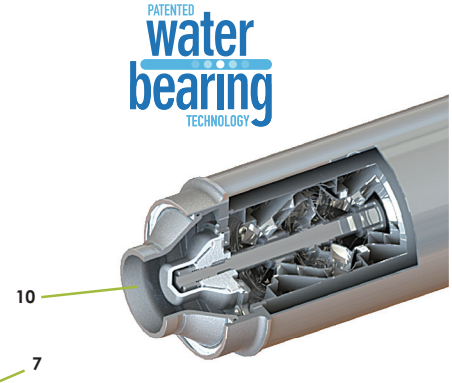
Models

MSB-90
MSB-120

The MSB series multi-stage centrifugal low pressure feed pumps provide a new level of reliability and efficiency in brackish RO pumps. The MSB pump series applications include use as a feed pump, product transfer pump, and an interstage booster.

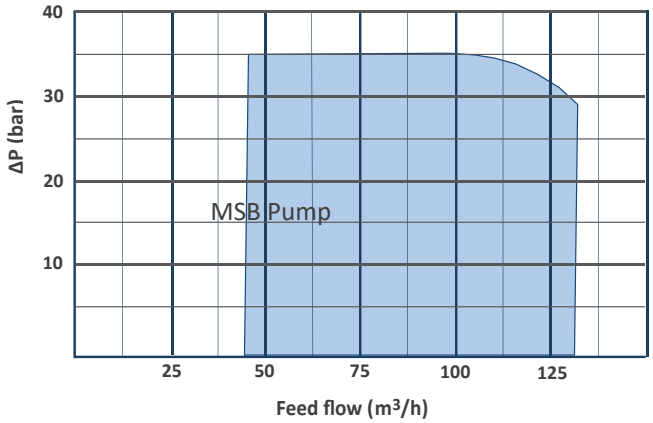
Special features of the MSB will prove to be an exceptional efficiency and quality pump. The unique design such as the patented WATER BEARING™ thrust bearing, product lubricated bearings, and maintenance-free design ensure years of trouble-free operation. This series is 316 SS components with Duplex SS shaft. This unit features fast delivery.





1	Shaft seal operates at low pressure
2	Flexible disc coupling
3	Victaulic pipe joints
4	316 SS stages
5	Precision leveling foot
6	Integrated motor adapter (anodized aluminum alloy)
7	Easy shaft alignment
8	Single shell housing
9	Inlet rotatable in 90° increments
10	WATER BEARING™

Hydraulic Coverage



Integrated Brackish Water/HP Feed Pump and Brine Energy Recovery

The **FEDCO** low pressure (LP) product line uses standardized pump, turbine and motor modules to achieve unprecedented hydraulic flexibility, excellent efficiency and low costs. The modules can be configured as a pump with a large flow range by using up to three (3) pump modules in parallel, a pump with integrated energy recovery, or as an energy recovery turbine/generator.

Let no energy go to waste in your brackish water RO system.

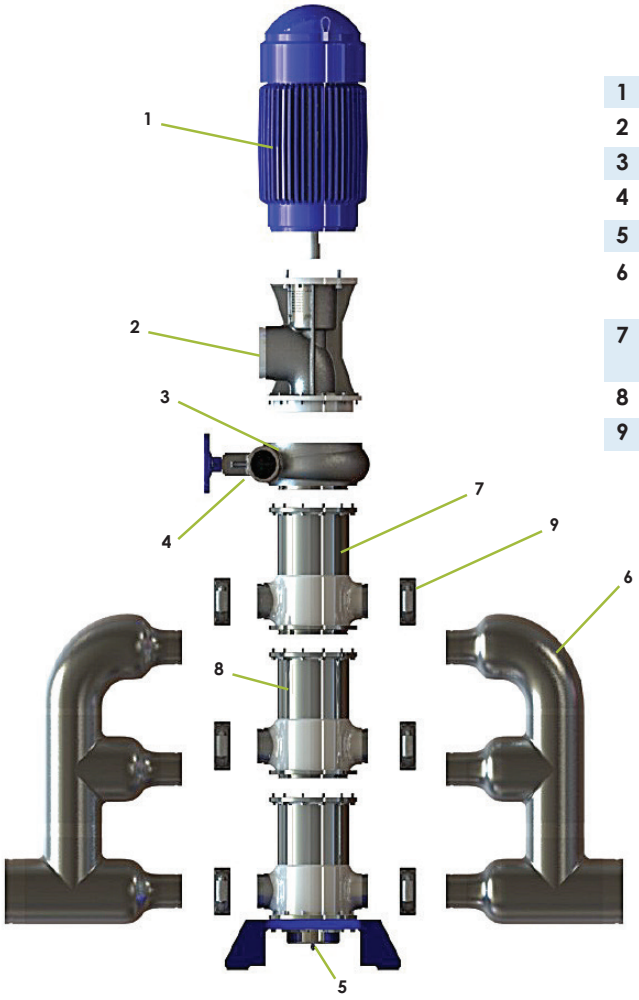
Performance

- Rated to 35 barg
- Flows to 750 m³/h
- Up to 350 kW

Features

- 316 SS construction
- Vertical or horizontal configuration
- Inline flow
- Compact size, low weight

Modular design reduces costs and increases application flexibility



1	Motor
2	Brine discharge module
3	Turbine module
4	Brine flow nozzle control
5	Thrust bearing, patented design - water lubricated
6	Manifold (if more than one pump module) 316 SS construction, provided by **FEDCO**
7	Pump module - up to three (3) depending on flow requirement
8	All wetted metallic parts are 316 SS or better
9	Pipe joint connectors

LPH - Low Pressure HEMI - Hydraulic Energy Management Integration

The LPH is revolutionizing pumping and energy recovery in brackish water reverse osmosis (BWRO). The rapid acceptance is driven by simple economics - an ERD is only worth using if the cost of saved energy can quickly offset the capital and installation costs of the ERD (a quick return on investment or ROI).

The unique modular construction of the **FEDCO** LP product line allows a few components to be confi gured in dozens of ways to achieve the performance requirements of a wide range of BWRO systems without high capital and installation costs. Maintenance costs are likewise reduced as maintenance spares and procedures are minimized for large installations.

The LPH takes full advantage of the modular concept with two (2) turbine options (LPT), five (5) stage options and up to three (3) pump modules (LPS) per LPH. Moreover, the turbine module is custom-designed and manufactured to match the specified range of turbine brine flow and pressure ranges.

SWRO ERDs have a much easier task of achieving a good return on investment (ROI). Up to 40 times more brine energy is available per m3 of permeate produced than in a BWRO system. Only an ERD with both a low capital costs and good energy recovery efficiency can be considered in a BWRO system.

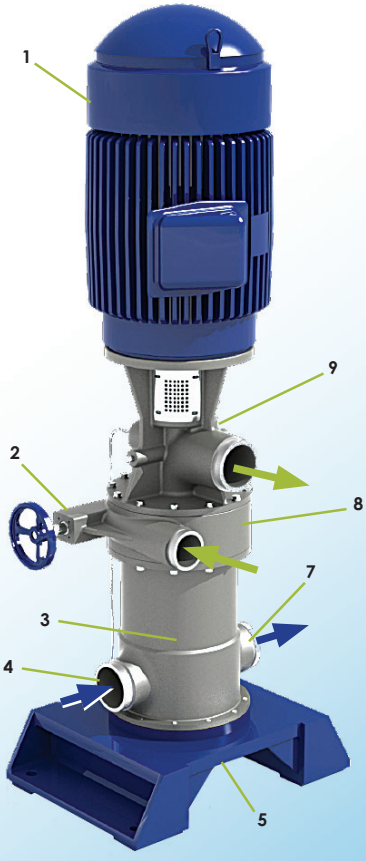
Modules Turbine

LPT-80
LPT-125
LPT-250

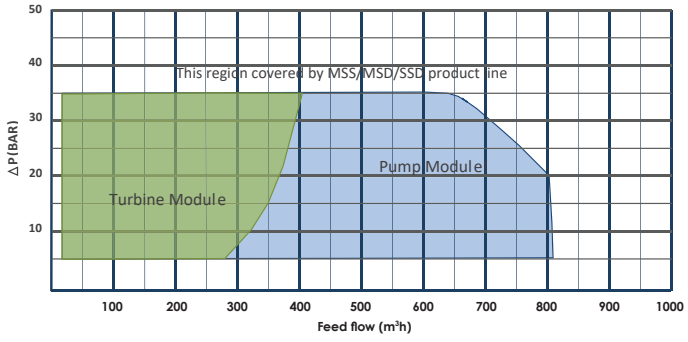
Pump
LPS-90
LPS-120
LPS-160
LPS-200
LPS-240

(Up to 3 modules in parallel)

1	TEFC motor, rated for vertical operation and with a VFD
2	Variable brine nozzle for flow and pressure control
3	316 SS or better material of construction
4	In-line connections for easy installation
5	Integrated water-lubricated bearing absorbs all rotor thrust
6	Base plate - powder coated or paint option
7	Victaulic type pipe joints
8	Turbine nozzle ring and impeller custom-manufactured
9	Rotatable turbine section for piping flexibility



Hydraulic Coverage



LPS - Low Pressure Pump BWRO Membrane Supply, Product Transfer, and More

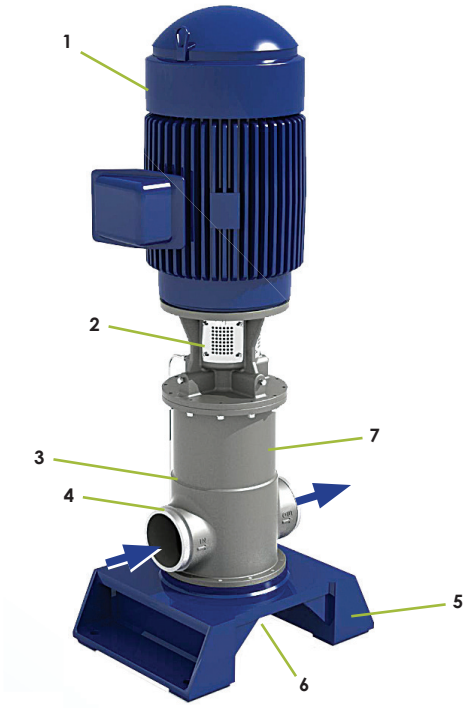
With effi ciency up to 80%, fl ows up to 750 m^3/hr and pressures up to 35 bar, the LPS is the ideal pump for a wide range of BWRO applications. 316 SS construction meets the most demanding corrosion requirements.

The vertical confi guration and low weight virtually eliminates foundation requirements. Shaft alignment is assured by highly accurate machine fits of the components.

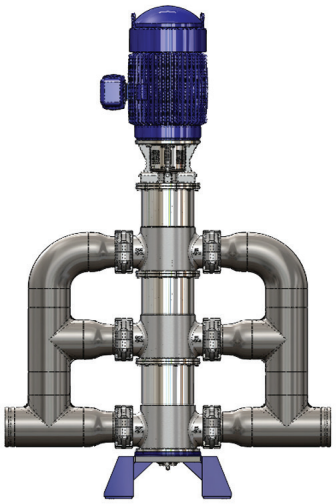
Model

LPS-160
LPS-200
LPS-240

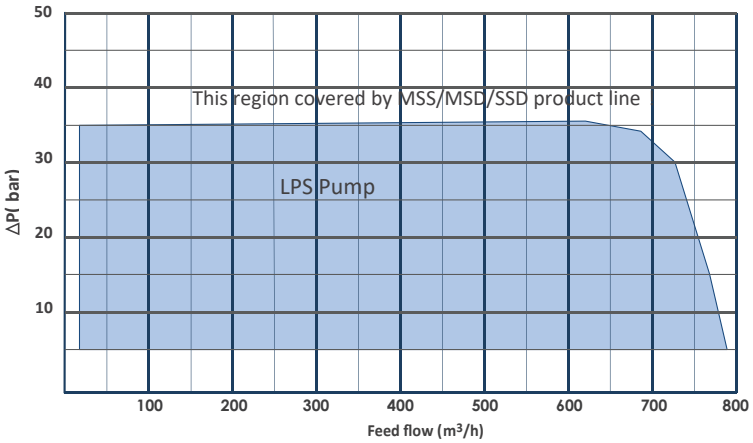
(Up to 3 modules in parallel)



1	Motor - rated for VFD usage, vertical operation, TEFC, NEMA or IEC frame
2	Mechanical seal housing
3	Pump module - up to three (3) in parallel
4	Victaulic style pipe joints
5	Baseplate- powder coated or paint option
6	Thrust bearing - water lubricated
7	316 SS construction



Hydraulic Coverage



LPD - Low Pressure Drive Conversion of Brine Hydraulic Energy into Electricity

The LPD turbine generator ERD uses brine hydraulic energy to drive a standard induction motor that acts as a generator to produce electrical energy. Integrated into the unit is a regenerative VFD that regulates the LPD to achieve brine flow and pressure as required for the desired membrane operating conditions while extracting the maximum amount of electrical energy available from the brine stream. The vertically mount motor eliminates a large baseplate. The shaft alignment is assured by highly accurate machine fits of the components.

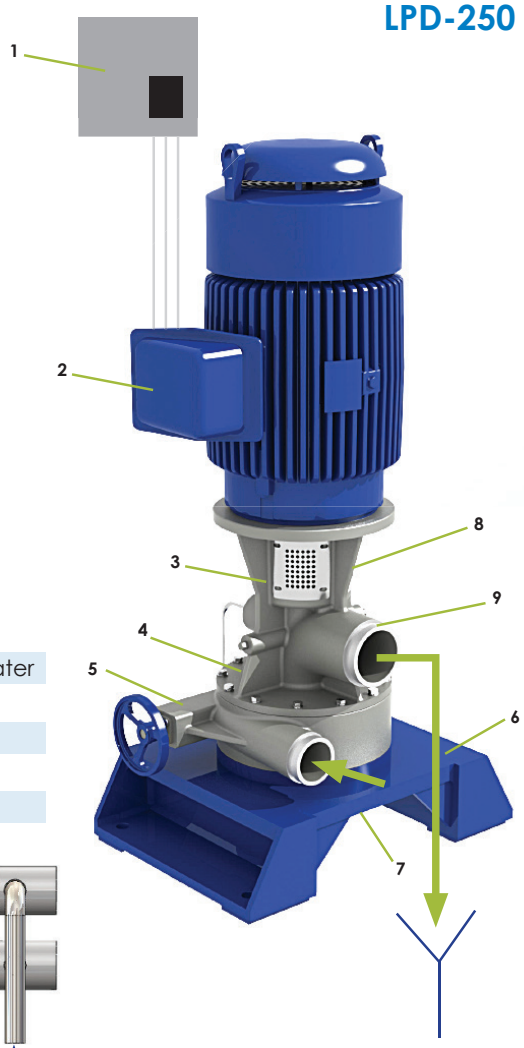
Modules Turbine

LPD-80
LPD-125
LPD-250

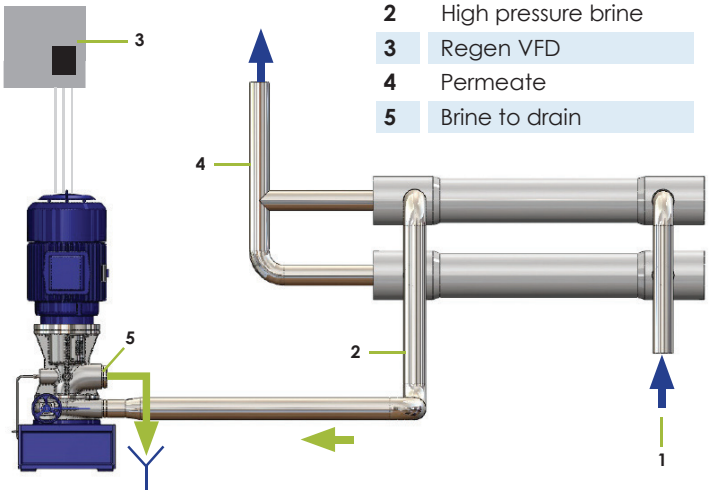
Applications:

- BWRO systems
- Retrofit in existing BWRO
- Replacement of Pressure Release Valve

1	Regenerative VFD - supplied by **FEDCO**
2	Motor - rated for VFD usage, vertical operation, TEFC, NEMA or IEC frame
3	Mechanical seal housing
4	Turbine module
5	Brine nozzle flow control
6	Baseplate - powder coated or paint option
7	Thrust bearing - water lubricated
8	316 SS or better material of construction
9	Victaulic type pipe joints



1	Pretreated feed water
2	High pressure brine
3	Regen VFD
4	Permeate
5	Brine to drain



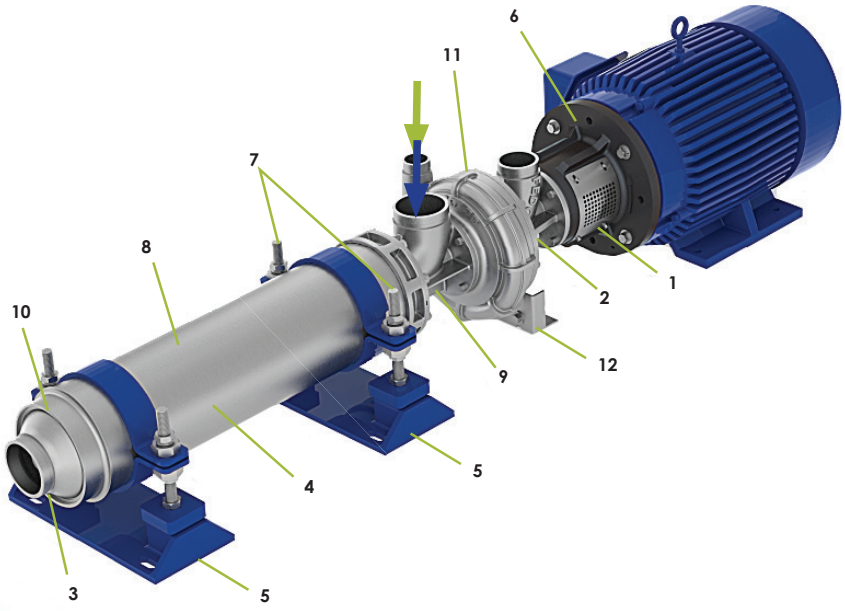
MSB-T - Brackish Feed Pump with Integrated Energy Recovery Turbine

The MSB-T combines the proven MSB multi-stage centrifugal feed pump coupled with a turbine module for brine energy recovery. THe MSB-T delivers unprecedented energy effi ciency in brackish RO systems over a broad range of fl ows and pressures. Applications include pure water RO, beverage RO, semi-conductor RO, DAF Systems and other industria RO systems.

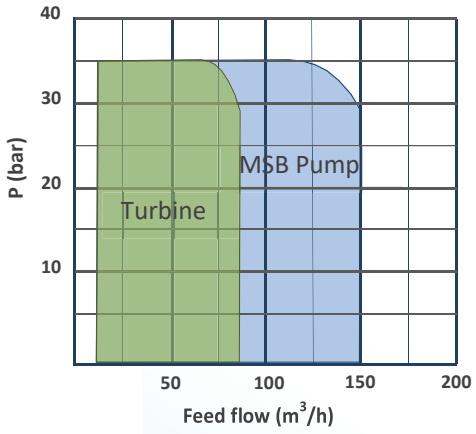
Modules Turbine

The low pressure MSB-T is loaded with unique features including the patented Water Bearing. Pump and turbine materials of constructions are 316SS with a Duplex SS shaft to meet the challenges of the harshest brackish water conditions. The turbine module utilizes custom-designed multi-vane turbine nozzles and impeller to achieve turbine efficiencies up to 85%.

MSB-T-90
MSB-T-120



1	Shaft seal operates at low pressure
2	Flexible disc coupling
3	Victaulic pipe joints
4	316 SS stages
5	Precision leveling foot
6	Integrated motor adapter (anodized aluminum alloy)
7	Easy shaft alignment
8	Single shell housing
9	Inlet rotatable in 90° increments
10	WATER BEARING™
11	Turbine module
12	Turbine module SS bracket



Typical Brackish Water or Low Pressure Installations

LPH with 3 modules in Singapore

LPD-125 in Spain

LPH-240/125 in Florida, USA

LPH-240/125 in California, USA

Upgrading Existing SWRO Systems with Modern High Effi ciency Pumps and ERDs

Pumps and ERDs are undergoing continuous improvement which is especally true with **FEDCO** products. Performance considered industry-leading, even a few years ago can be eclipsed by newer designs and improved manufacturing processes.

FEDCO offers many ways to revitalize old RO systems to achieve performance rivaling new systems.

Retrofits - Upgrading High Pressure Feed Pumps

Replace noisy and unreliable Positive Displacement (PD) pumps with smooth and quiet **FEDCO** MSS pumps. FEDCO pumps eliminate:

- Pulsdion dampeners
- Suction stabilizers
- Packing and packing leakage
- Oil and grease lubrication
- Belts and belt guards
- Sheaves/pulleys
- Special motors
- Unsightly corrosions

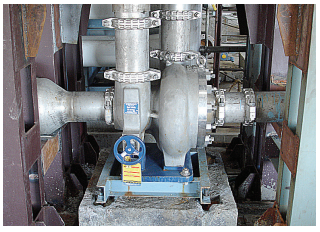
Are you satisfi ed with your PD pump? Then consider adding a **FEDCO** HPB as an ERD. The FEDCO unit reduces pump discharge pressure by up to 50% resulting in a large energy savings, reduction in cross-head and crank bearing loads, reduction in bearing temperatures, improved valve life and quieter operation.

Retrofits - Replacing Old Low Efficiency Turbochargers

Why replace an old ineffi cient turbocharger with an other ineffi cient turbocharger? **FEDCO**'s high effi ciency HPB turbochargers will save more energy and provide a three year (36 months) warranty. Its a smart way to save energy and raise plant reliability.

Retrofits - Replace Isobaric Chambers

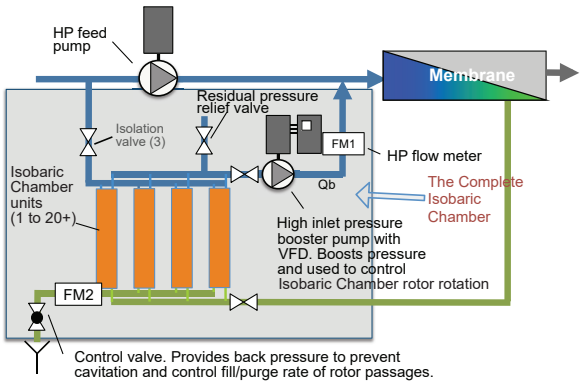
Isobaric chambers are noted for good efficiency, high complexity, daunting maintenance and brine mixing. **FEDCO** offers a package that directly replaces an existing isobaric chamber without disturbing the existing HP pump or membrane array. With the **FEDCO** replacement package, you will enjoy improved permeate quality, quieter operation, reduced maintenance and most important - lower cost permeate!



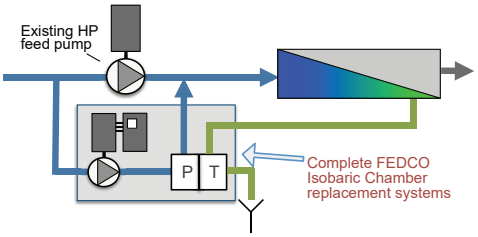
Retrofit installation at a power station in India

From this...
Typical Isobaric Chamber ERD System

to this!
FEDCO Isobaric Chamber Replacement Package



A simplified system diagram[1] – special flushing piping, safety interlocks, Isobaric Chamber sample ports, etc. omitted for clarity. Indicated flows are approximate.



POMPE MULTISTADIO CENTRIFUGHE VERICALI / GRUNDFOS VERTICAL MULTISTAGE CENTRIFUGAL PUMPS

CR - CRI - CRN

CR - CRI - CRN

CARATTERISTICHE GENERALI:
Le pompe CR, CRI e CRN sono pompe centrifughe multistadio verticali. La costruzione in linea consente di installare la pompa in un impianto orizzontale ad un tubo dove le bocche di aspirazione e di mandata si trovano sullo stesso piano orizzontale e presentano le stesse dimensioni del tubo. Questa costruzione consente di avere una maggiore compattezza della struttura della pompa e della tubazione. Le pompe Grundfos CR sono disponibili in diverse taglie e grandezze. Le pompe CR sono idonee per una varietà di applicazioni dal pompaggio di acqua potabile e al trasferimento di liquidi chimici. Le pompe sono disponibili per diverse applicazioni di pompaggio dove le richieste e i materiali incontrono specifiche richieste. Le pompe CR comprendono due componenti principali: il motore e l'unità pompa. Il motore della pompa CR è un motore Grundfos conforme alle norme EN. L' unità pompa comprende componenti idraulici ottimizzati, diversi tipi di attacchi, una camicia esterna, una testa pompa e diverse altre parti. Le pompe CR sono disponibili in diverse versioni di materiali a seconda del liquido pompato.

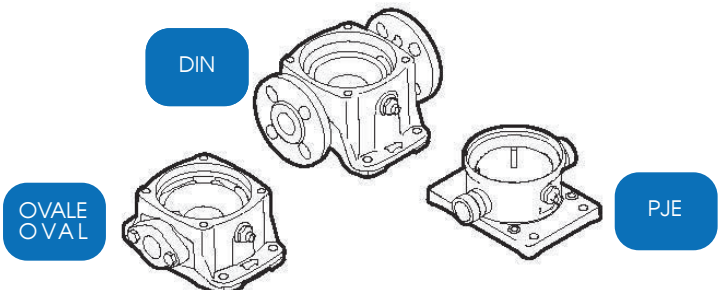
MATERIALE DELLA POMPA
La variante di materiale deve essere scelta sulla base del liquido da pompare, vedere. La gamma dei prodotti è costituita dai tre tipi di base:
• CR, CRI per liquidi puliti, non aggressivi, come acqua potabile e sostanze oliose
•CRN CRN per liquidi industrialie acidi (contattare l' ufficio tecnico Hytek). Per liquidi salini o a contenuto di cloruro, come ad esempio l'acqua di mare, sono disponibili pompe CRT in titanio.

ATTACCHI DELLA POMPA
La scelta dell' attacco della pompa dipende dalla pressione nominale e dalla tubazione. Le pompe CR, CRI e CRN offrono un'ampia gamma di attacchi flessibili per soddisfare tutte le esigenze, tra i quali:
•Flangia ovale (BSP)
•Flangia DIN
•Giunto PJE
•Altri tipi di attacco a richiesta.

GENERAL FEATURES
Grundfos multistage in-line centrifugal pumps, types CR CRI and CRN, are designed for a wide range of applications.CR, CRI, CRN pumps are suitable for liquid transfer, circulation and pressure boosting of cold or hot clean liquids. CRN pumps is used in systems where all parts in contact with the liquid are made of high-grade stainless steel. Pumped liquids Thin, clean, non-explosive liquids, not containing solid particles or fibres. The liquid must not attack the pump materials chemically. When pumping liquids with a density and/or viscosity higher than that of water, use motors with correspondingly higher outputs, if required The CR pumps include two principals component: the motor and the unit pump. The CR motor pump is a Grundfos motor and It is EN compliance. The pump unit includes optimized hydraulic components, different types of connections, an external protection, a head pump, and other different spare parts. The CR pumps are available in different models and materials in according to the pumped liquid.

MATERIAL OF THE PUMP
The material of the pumps has to be select on the base of the liquid to pump. The range of the products is constituted by three base types:
• CR, CRI for clean liquids, not aggressive, as drinkable water and oils substances.
• CRN CRN for industrials acid liquids (contact the technical Hytek office). For salty liquid or liquid with chloride, as the sea water, are available pumps in titanium (series CRT).

PUMPS CONNECTIONS
The choice of the connections pump depends from the nominal pressure and from the pipeline. The CR, CRI and CRN pumps offer an ample range of flexible connections to satisfy all the demands, among which:
• Oval flange (BSP)
• DIN flenge
• PJE joint
• Other types of connections on request.



Minima pressione di ingresso - NPSH

Si consiglia di calcolare la pressione di ingresso "H" quando:
• la temperatura del liquido è elevata;
• la portata è notevolmente superiore alla portata nominale della pompa
• l'acqua viene aspirata da grandi profondità
• le condizioni di aspirazione sono critiche.

Per evitare la cavitazione, assicurarsi che sia presente una pressione minima in aspirazione della pompa. È possibile calcolare il massimo sollevamento di aspirazione "H" in metri di prevalenza come segue:

$$H = p_b \times 10{,}2 - NPSH - H_f - H_v - H_s$$

- p_b = Pressione barometrica in bar. (La pressione barometrica può essere impostata a 1 bar). Nei sistemi chiusi, p_b indica la pressione di sistema in bar.
- **NPSH** = Prevalenza di aspirazione netta positiva (Net Positive Suction Head) espressa in metri di prevalenza. (Da leggersi sulla curva NPSH nella massima portata erogata dalla pompa).
- H_f = Perdite per attrito nel tubo di aspirazione espresse in metri di prevalenza.(Alla portata massima erogata dalla pompa).
- H_v = Pressione del vapore espressa in metri di prevalenza. (Da leggersi sulla scala di pressione del vapore. "Hv" dipende dalla temperatura del liquido "Tm").
- **Hs** = Margine di sicurezza = minimo 0,5 metri di prevalenza.

Se il valore "H" risultante è positivo, la pompa può funzionare con un dislivello in aspirazione di max. "H" metri di prevalenza. Se il valore "H" risultante è negativo, è necessaria una pressione di ingresso di almeno "H" metri di prevalenza.

Minimum inlet pressure

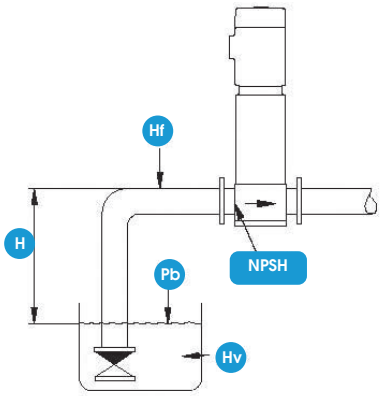
We recommend to calculate the inlet pressure "H" when:
• the temperature of the liquid is elevated;
• the flow rate is notably superior to the nominal flow rate of the pump
• water is suction by great depths
• the suction conditions are critical.

To avoid the cavitation, to make sure that a least pressure is present in aspiration of the pump. It is possible to calculate the maximum load aspiration "H" in meters of prevalence as it follows:

$$H = p_b \times 10{,}2 - NPSH - H_f - H_v - H_s$$

- p_b = Barometric pressure in bar. (Barometric pressure can be set to 1 bar.) In closed systems, pb indicates the system pressure in bar.
- **NPSH** = Net Positive Suction Head in metres head (to be read from the NPSH curve at the highest flow the pump will be delivering).
- H_f = Friction loss in suction pipe in metres head at the highest flow the pump will be delivering.
- H_v= Vapour pressure in metres head (to read it on the graphic vapour pressure range. H_v depend to the Liquid temperature "Tm"
- **Hs** = Safety margin = minimum 0.5 metres head.

If the calculated "H" is positive, the pump can operate at a suction lift of maximum "H" metres head. If the calculated "H" is negative, an inlet pressure of minimum "H"metres head is required.

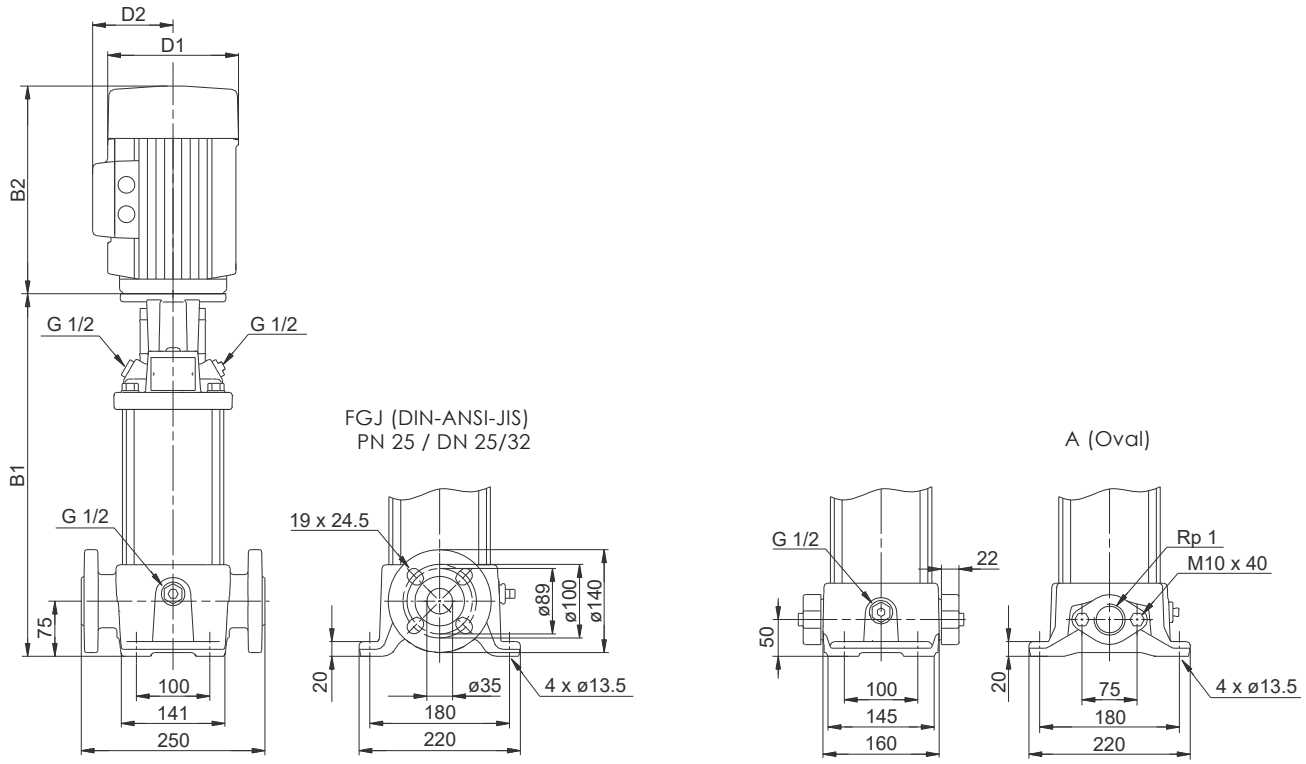


Minima pressione di ingresso - NPSH Minimum inlet pressure - NPSH

Nota: per evitare la cavitazione non scegliere mai una pompa il cui punto di lavoro è situato troppo a destra sulla curva NPSH. Verificare sempre il valore NPSH della pompa in corrispondenza della massima portata possibile.

Due to the risk of overheating, do not use the pump at flows below the minimum flow rate.The curves below show the minimum flow rate as a percentage of the nominal flow rate in relation to the liquid temperature

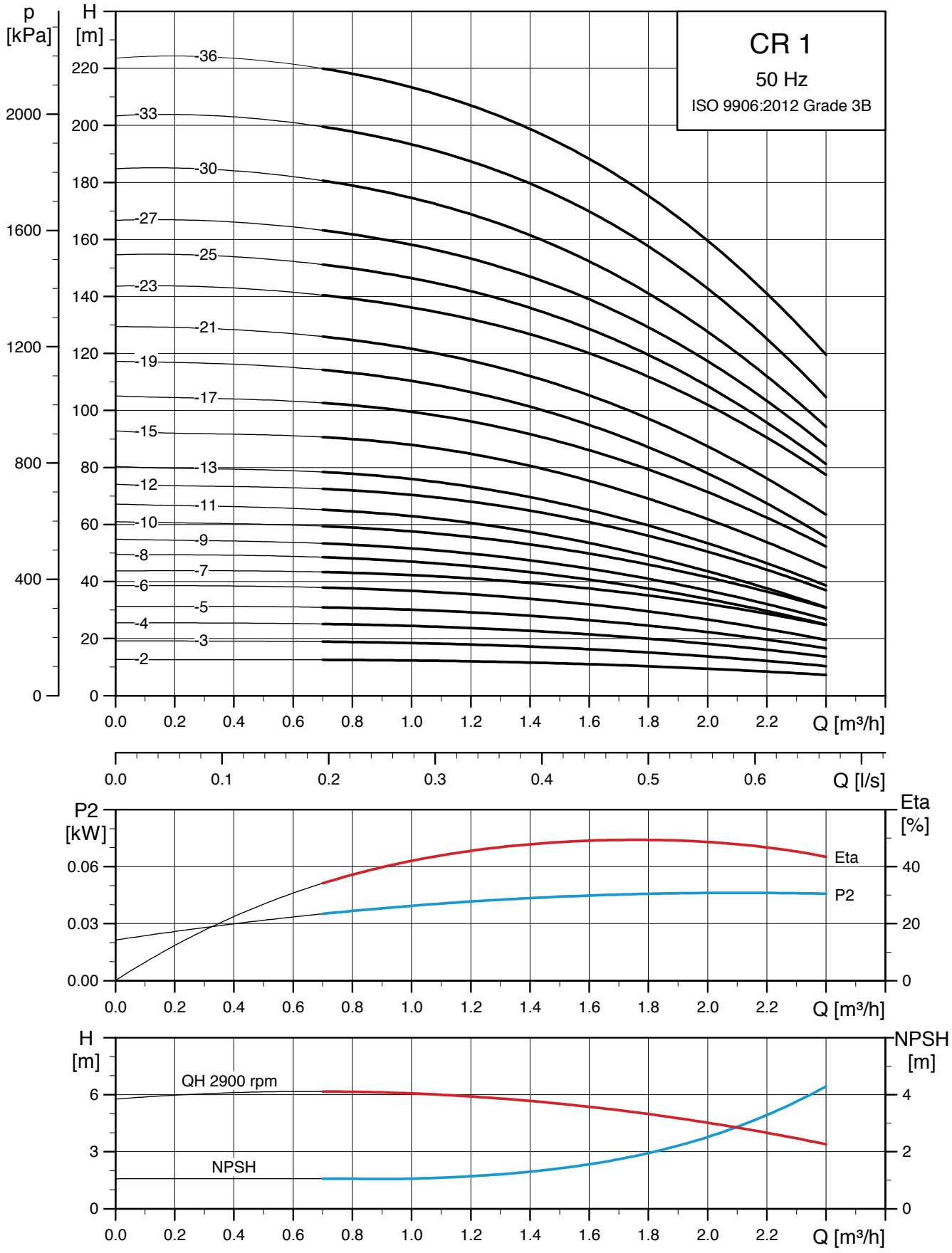
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR1- CRN1 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR1- CRN1



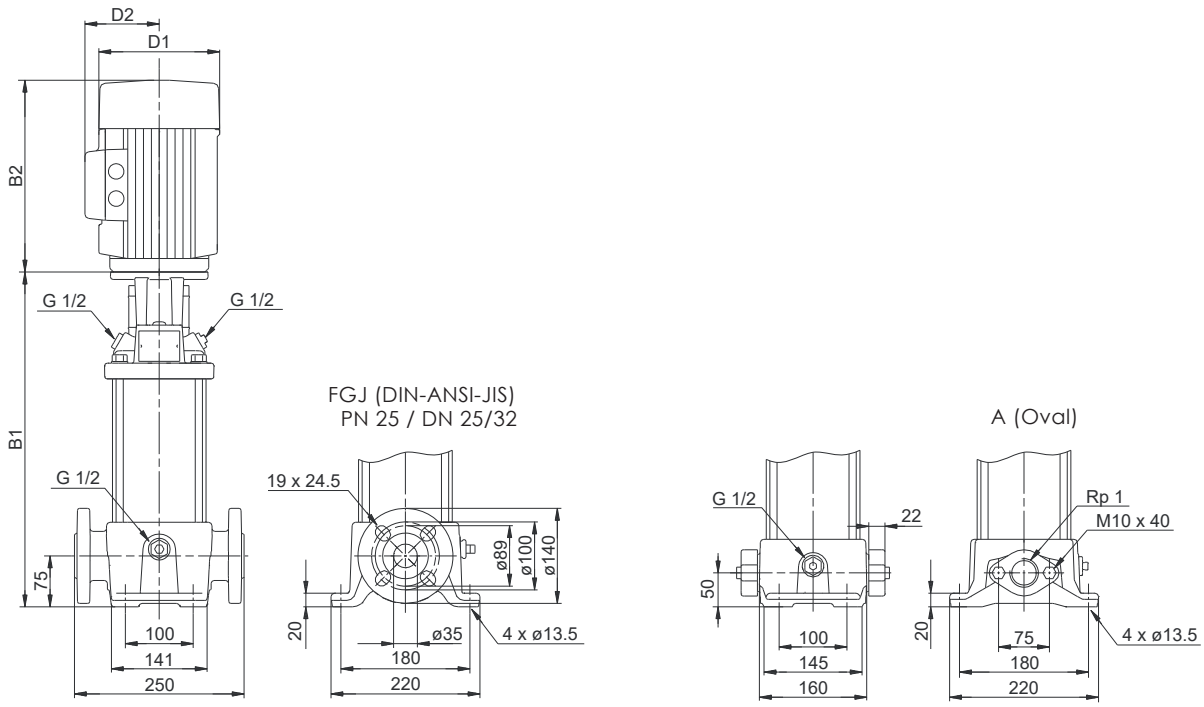
Dimensions and weights

Pump type	Motor P_2 [kW]	CR							
		Dimension [mm]						Net weight [kg]	
		Oval flange		DIN flange		D1	D2	Oval flange	DIN flange
		B1	B1+B2	B1	B1+B2				
CR 1-2	0.37	254	445	279	470	141	109	18	23
CR 1-3	0.37	254	445	279	470	141	109	18	23
CR 1-4	0.37	272	463	297	488	141	109	19	23
CR 1-5	0.37	290	481	315	506	141	109	19	24
CR 1-6	0.37	308	499	333	524	141	109	20	24
CR 1-7	0.37	326	517	351	542	141	109	20	25
CR 1-8	0.55	344	535	369	560	141	109	21	26
CR 1-9	0.55	362	553	387	578	141	109	21	26
CR 1-10	0.55	380	571	405	596	141	109	22	26
CR 1-11	0.55	398	589	423	614	141	109	22	27
CR 1-12	0.75	422	653	447	678	141	109	24	29
CR 1-13	0.75	440	671	465	696	141	109	25	29
CR 1-15	0.75	476	707	501	732	141	109	26	30
CR 1-17	1.10	512	763	537	788	141	109	29	33
CR 1-19	1.10	548	799	573	824	141	109	30	34
CR 1-21	1.10	584	835	609	860	141	109	30	35
CR 1-23	1.10	620	871	645	896	141	109	31	36
CR 1-25	1.50	-	-	697	978	178	110	-	44
CR 1-27	1.50	-	-	733	1014	178	110	-	44
CR 1-30	1.50	-	-	787	1068	178	110	-	46
CR 1-33	2.20	-	-	841	1162	178	110	-	47
CR 1-36	2.20	-	-	895	1216	178	110	-	49

CR 1


CR 1
50 Hz
ISO 9906:2012 Grade 3B
p [kPa]
H [m]
-36
-33
-30
-27
-25
-23
-21
-19
-17
-15
-13
-12
-11
-10
-9
-8
-7
-6
-5
-4
-3
-2
Q [m³/h]
Q [l/s]
P2 [kW]
Eta [%]
Eta
P2
H [m]
QH 2900 rpm
NPSH
NPSH [m]

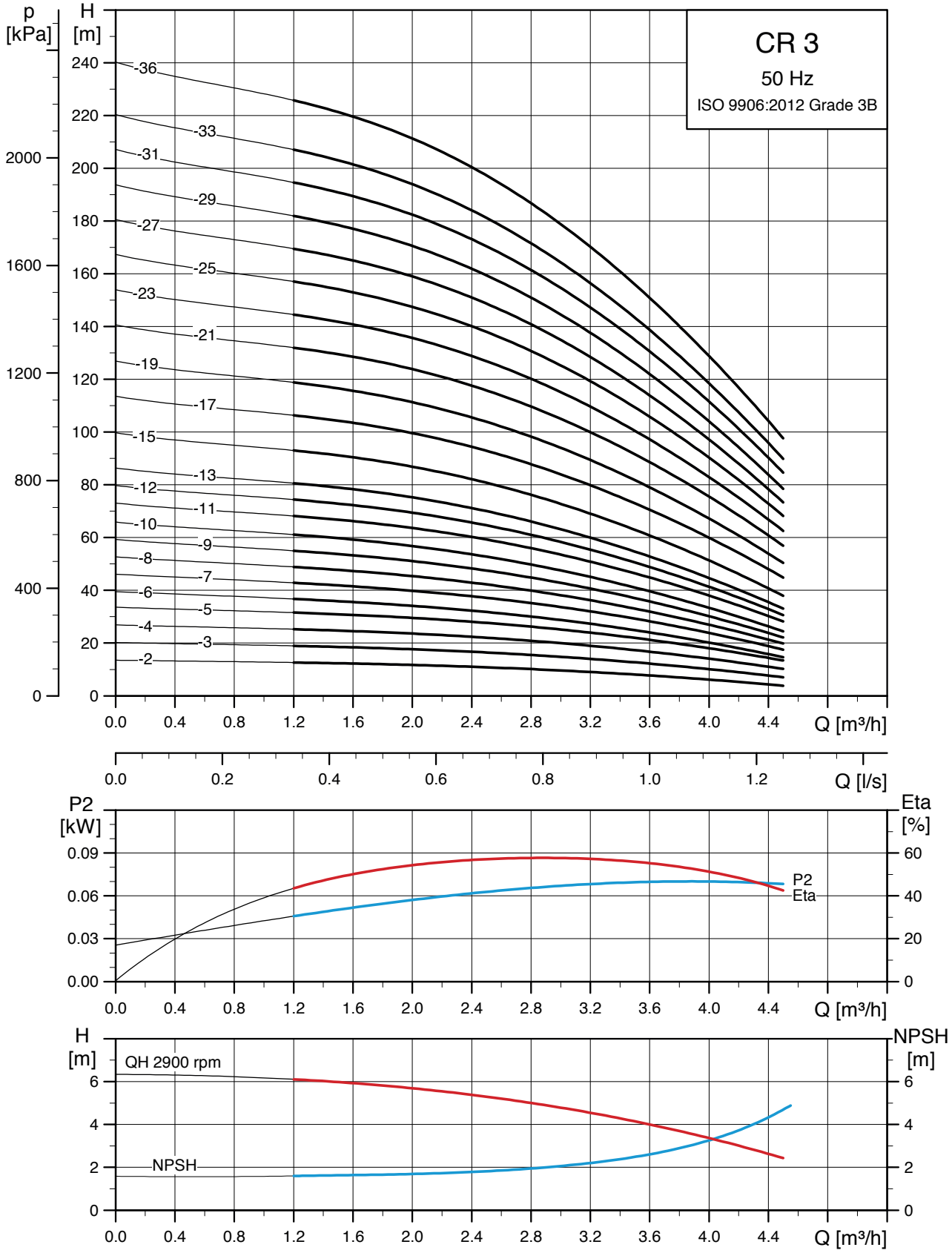
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR3- CRN3 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR3- CRN3



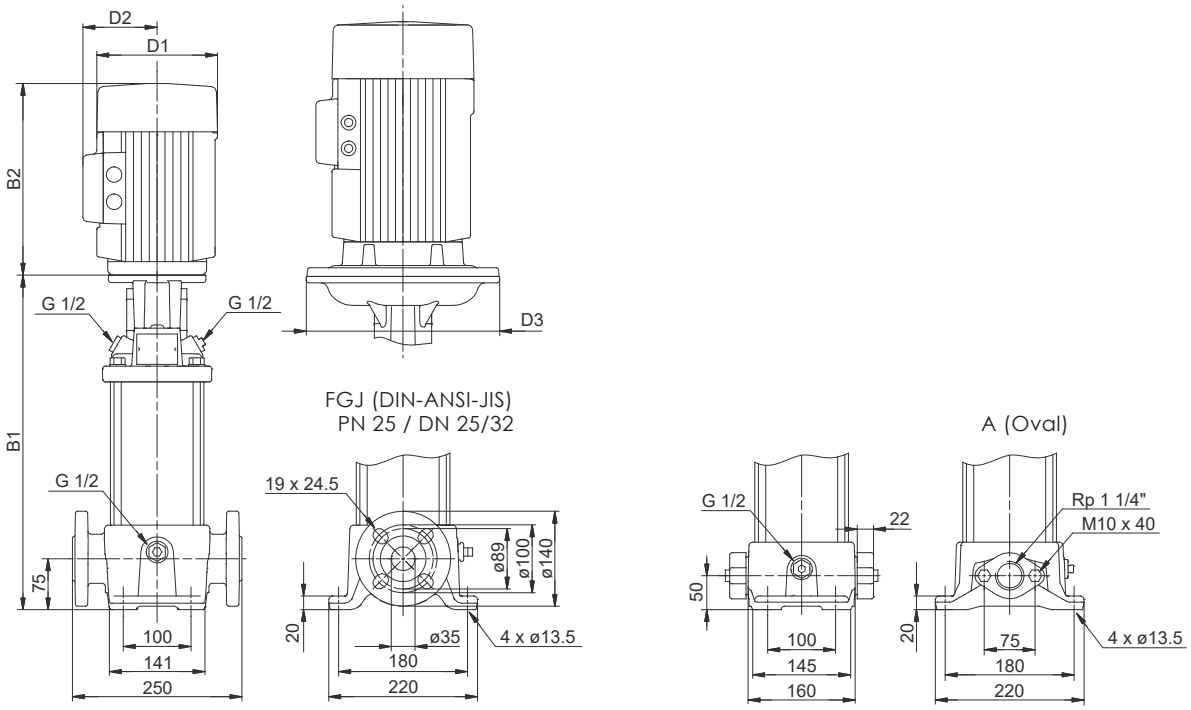
Dimensions and weights

Pump type	Motor P_2 [kW]	CR							
		Dimension [mm]						Net weight [kg]	
		Oval flange		DIN flange		D1	D2	Oval flange	DIN flange
		B1	B1+B2	B1	B1+B2				
CR 3-2	0.37	254	445	279	470	141	109	18	23
CR 3-3	0.37	254	445	279	470	141	109	18	23
CR 3-4	0.37	272	463	297	488	141	109	19	23
CR 3-5	0.37	290	481	315	506	141	109	19	24
CR 3-6	0.55	308	499	333	524	141	109	20	25
CR 3-7	0.55	326	517	351	542	141	109	21	25
CR 3-8	0.75	350	581	375	606	141	109	23	27
CR 3-9	0.75	368	599	393	624	141	109	23	28
CR 3-10	0.75	386	617	411	642	141	109	24	28
CR 3-11	1.1	404	655	429	680	141	109	26	31
CR 3-12	1.1	422	673	447	698	141	109	27	31
CR 3-13	1.1	440	691	465	716	141	109	27	32
CR 3-15	1.1	476	727	501	752	141	109	28	32
CR 3-17	1.5	528	809	553	834	178	110	36	40
CR 3-19	1.5	564	845	589	870	178	110	37	41
CR 3-21	2.2	600	921	625	946	178	110	38	42
CR 3-23	2.2	636	957	661	982	178	110	39	43
CR 3-25	2.2	-	-	697	1018	178	110	-	44
CR 3-27	2.2	-	-	733	1054	178	110	-	45
CR 3-29	2.2	-	-	769	1090	178	110	-	46
CR 3-31	3	-	-	809	1144	198	120	-	53
CR 3-33	3	-	-	845	1180	198	120	-	53
CR 3-36	3	-	-	899	1234	198	120	-	55

CR 3


CR 3
50 Hz
ISO 9906:2012 Grade 3B
p [kPa]
H [m]
-36
-33
-31
-29
-27
-25
-23
-21
-19
-17
-15
-13
-12
-11
-10
-9
-8
-7
-6
-5
-4
-3
-2
Q [m³/h]
Q [l/s]
P2 [kW]
Eta [%]
P2
Eta
H [m]
QH 2900 rpm
NPSH
NPSH [m]

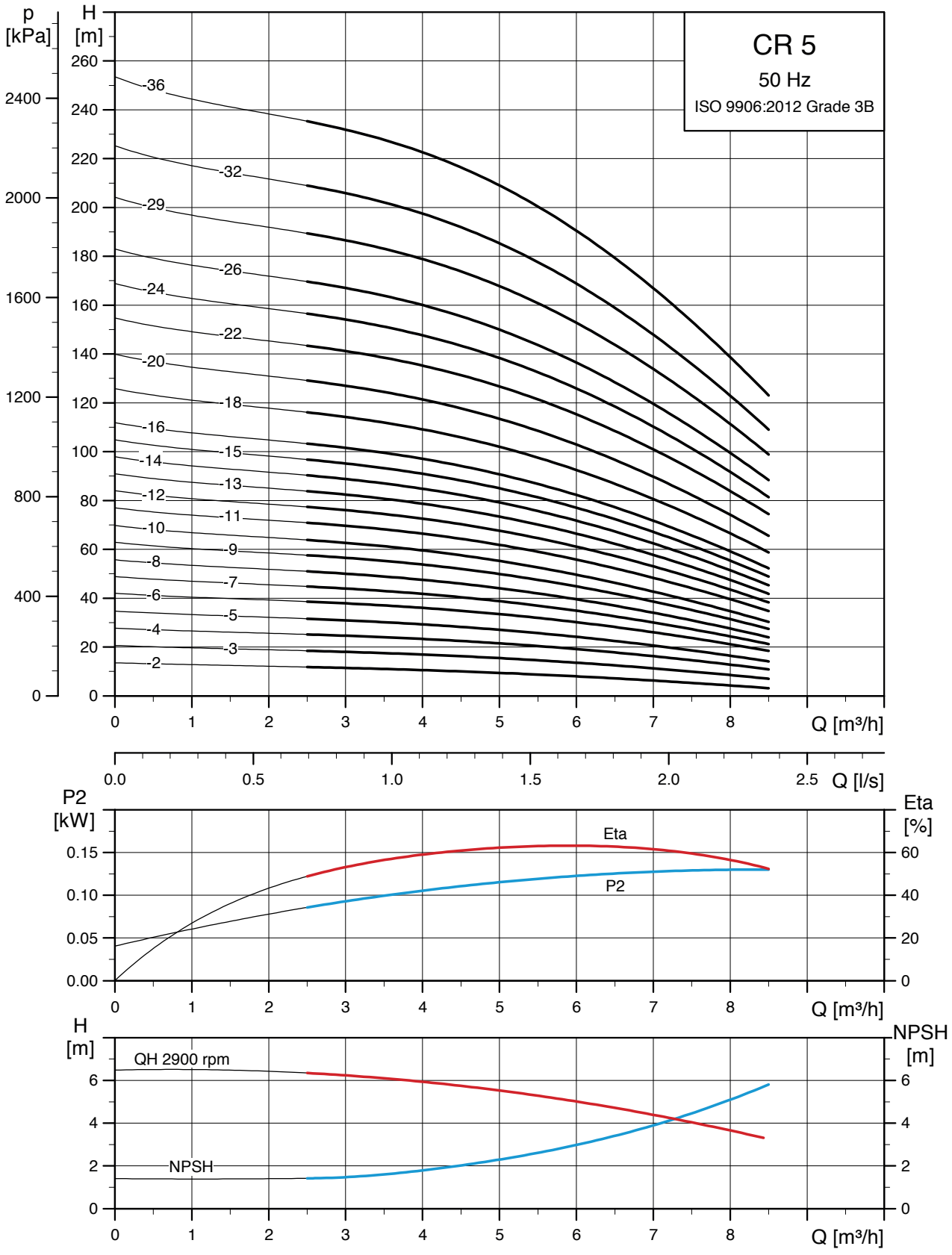
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR5- CRN5 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR5- CRN5



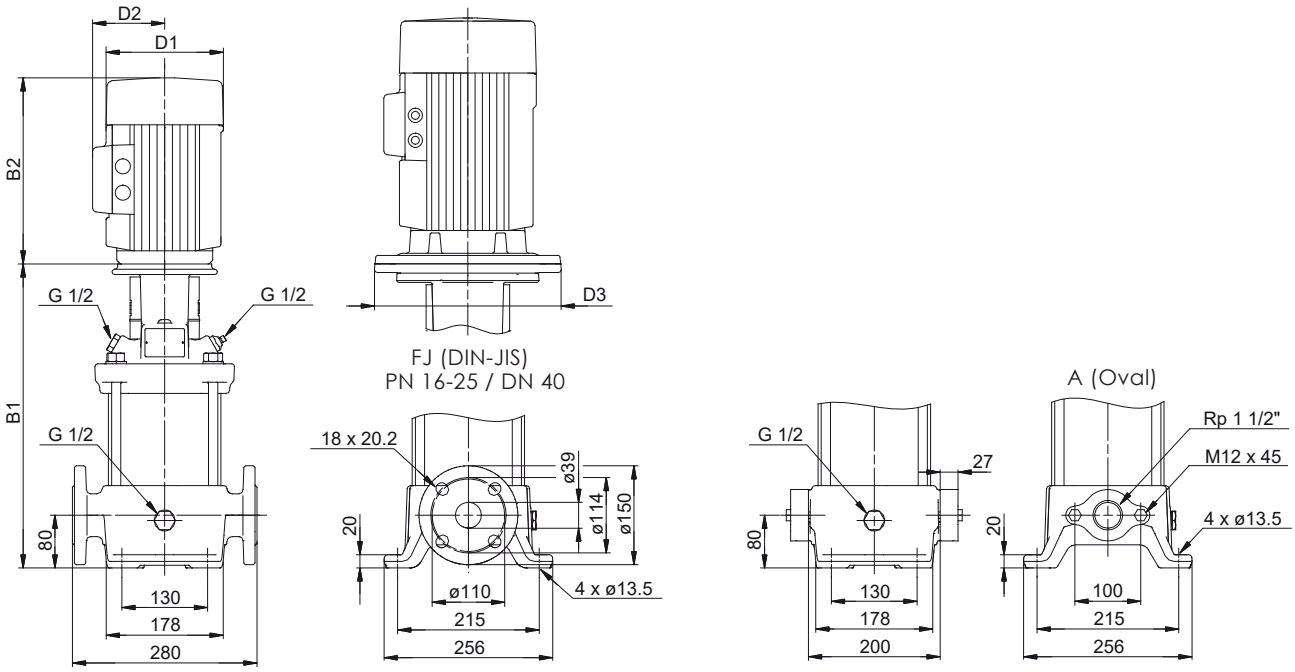
Dimensions and weights

Pump type	Motor P_2 [kW]	CR								
		Dimension [mm]							Net weight [kg]	
		Oval flange		DIN flange		D1	D2	D3	Oval flange	DIN flange
		B1	B1+B2	B1	B1+B2					
CR 5-2	0.37	254	445	279	470	141	109	-	18	23
CR 5-3	0.55	281	472	306	497	141	109	-	20	24
CR 5-4	0.55	308	499	333	524	141	109	-	20	25
CR 5-5	0.75	341	572	366	597	141	109	-	22	27
CR 5-6	1.10	368	619	393	644	141	109	-	25	30
CR 5-7	1.10	395	646	420	671	141	109	-	26	30
CR 5-8	1.10	422	673	447	698	141	109	-	26	31
CR 5-9	1.50	465	746	490	771	178	110	-	34	38
CR 5-10	1.50	492	773	517	798	178	110	-	34	39
CR 5-11	2.20	519	840	544	865	178	110	-	36	40
CR 5-12	2.20	546	867	571	892	178	110	-	36	41
CR 5-13	2.20	573	894	598	919	178	110	-	37	41
CR 5-14	2.20	600	921	625	946	178	110	-	37	42
CR 5-15	2.20	627	948	652	973	178	110	-	38	43
CR 5-16	2.20	654	975	679	1000	178	110	-	38	43
CR 5-18	3.00	712	1047	737	1072	198	120	-	46	50
CR 5-20	3.00	766	1101	791	1126	198	120	-	47	52
CR 5-22	4.00	820	1192	845	1217	220	134	-	57	62
CR 5-24	4.00	-	-	899	1271	220	134	-	-	63
CR 5-26	4.00	-	-	953	1325	220	134	-	-	64
CR 5-29	4.00	-	-	1034	1406	220	134	-	-	66
CR 5-32	5.50	-	-	1145	1536	220	134	300	-	82
CR 5-36	5.50	-	-	1253	1644	220	134	300	-	84

CR 5


CR 5
50 Hz
ISO 9906:2012 Grade 3B
p [kPa]
H [m]
-36
-32
-29
-26
-24
-22
-20
-18
-16
-15
-14
-13
-12
-11
-10
-9
-8
-7
-6
-5
-4
-3
-2
Q [m³/h]
Q [l/s]
P2 [kW]
Eta [%]
Eta
P2
H [m]
QH 2900 rpm
NPSH
NPSH [m]

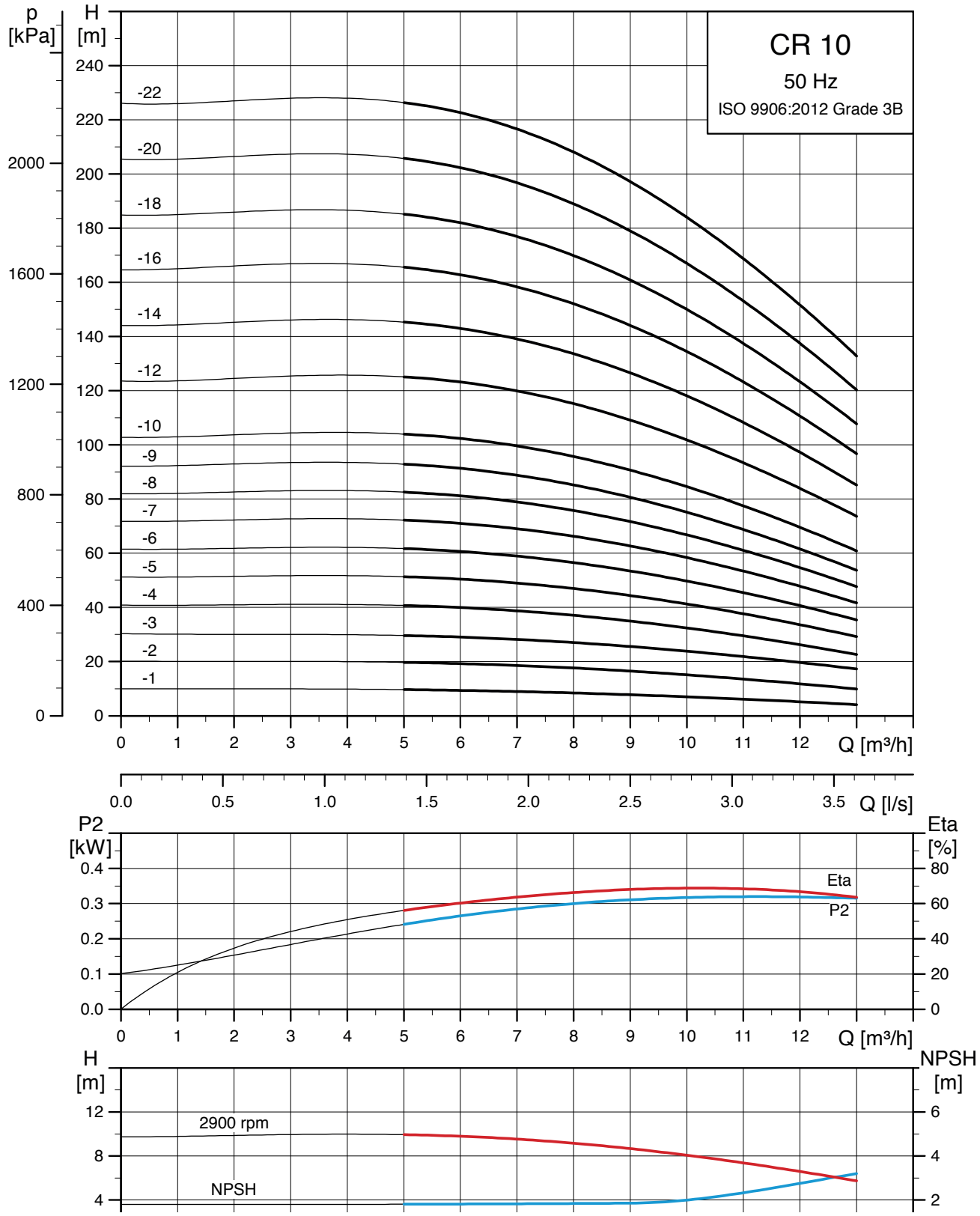
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR10- CRN10 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR10- CRN10



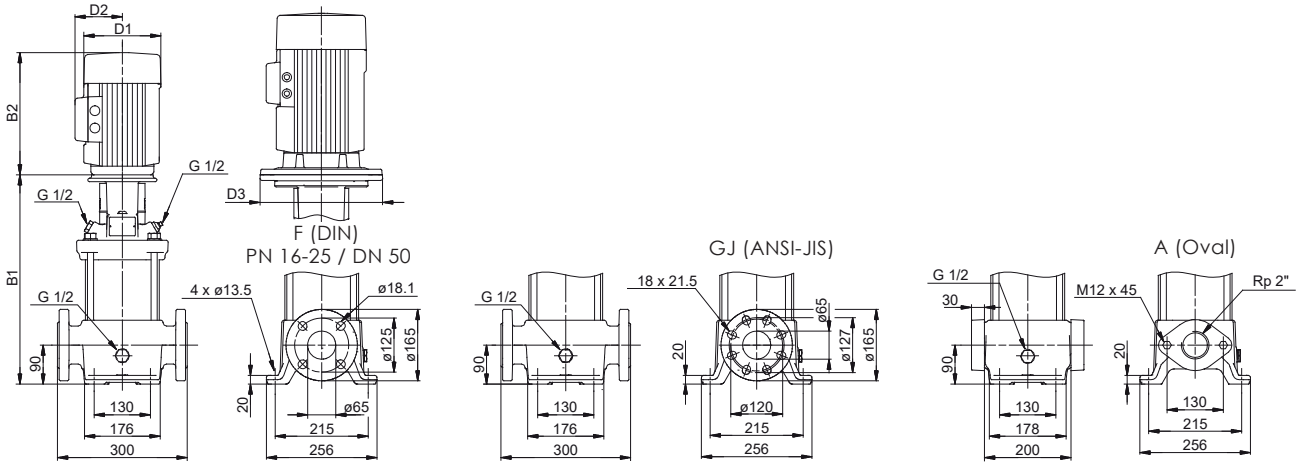
Dimensions and weights

Pump type	Motor P_2 [kW]	CR								
		Dimension [mm]							Net weight [kg]	
		Oval flange		DIN flange		D1	D2	D3	Oval flange	DIN flange
		B1	B1+B2	B1	B1+B2					
CR 10-1	0.37	343	534	343	534	141	109	-	31	34
CR 10-2	0.75	347	578	347	578	141	109	-	34	36
CR 10-3	1.10	377	628	377	628	141	109	-	37	39
CR 10-4	1.50	423	704	423	704	178	110	-	45	47
CR 10-5	2.20	453	774	453	774	178	110	-	46	49
CR 10-6	2.20	483	804	483	804	178	110	-	47	50
CR 10-7	3.00	518	853	518	853	198	120	-	54	57
CR 10-8	3.00	548	883	548	883	198	120	-	55	58
CR 10-9	3.00	578	913	578	913	198	120	-	56	59
CR 10-10	4.00	608	980	608	980	220	134	-	66	69
CR 10-12	4.00	668	1040	668	1040	220	134	-	69	71
CR 10-14	5.50	760	1151	760	1151	220	134	300	91	94
CR 10-16	5.50	820	1211	820	1211	220	134	300	93	96
CR 10-18	7.50	-	-	880	1259	260	159	300	-	109
CR 10-20	7.50	-	-	940	1319	260	159	300	-	112
CR 10-22	7.50	-	-	1000	1379	260	159	300	-	114

CR 10


CR 10
50 Hz
ISO 9906:2012 Grade 3B
p [kPa]
H [m]
-22
-20
-18
-16
-14
-12
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
Q [m³/h]
Q [l/s]
P2 [kW]
Eta [%]
Eta
P2
H [m]
NPSH [m]
2900 rpm
NPSH

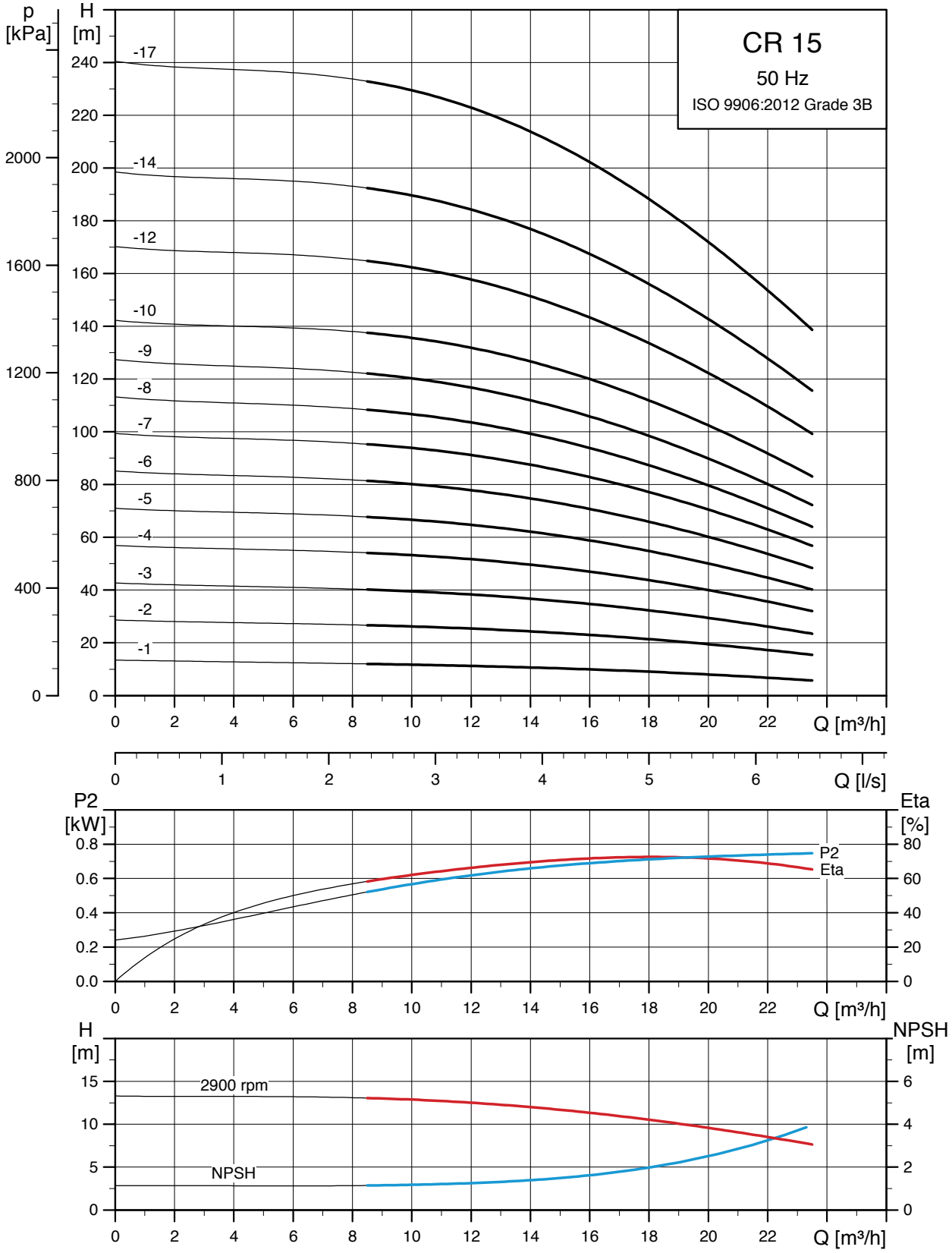
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR15- CRN15 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR15- CRN15



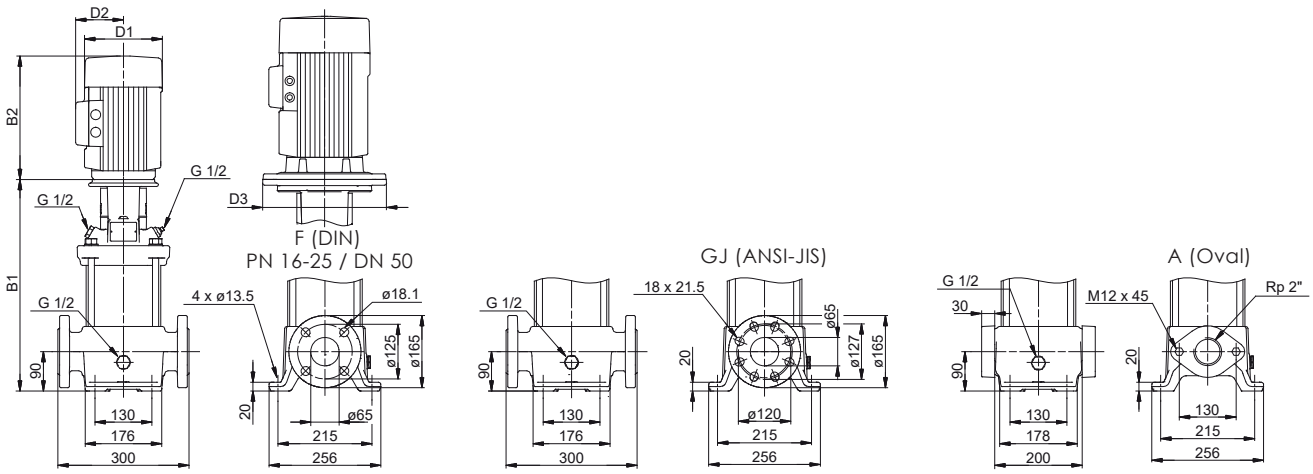
Dimensions and weights

Pump type	Motor P_2 [kW]	Dimension [mm]							Net weight [kg]	
		Oval flange		DIN flange		D1	D2	D3	Oval flange	DIN flange
		B1	B1+B2	B1	B1+B2					
CR 15-1	1.10	400	651	400	651	141	109	-	41	42
CR 15-2	2.20	415	736	415	736	178	110	-	49	50
CR 15-3	3.00	465	800	465	800	198	120	-	56	57
CR 15-4	4.00	510	882	510	882	220	134	-	67	68
CR 15-5	4.00	555	927	555	927	220	134	-	68	69
CR 15-6	5.50	632	1023	632	1023	220	134	300	90	91
CR 15-7	5.50	677	1068	677	1068	220	134	300	92	93
CR 15-8	7.50	-	-	722	1101	260	159	300	-	105
CR 15-9	7.50	-	-	767	1146	260	159	300	-	107
CR 15-10	11.00	-	-	889	1360	314	204	350	-	149
CR 15-12	11.00	-	-	979	1450	314	204	350	-	153
CR 15-14	11.00	-	-	1069	1540	314	204	350	-	157
CR 15-17	15.00	-	-	1204	1675	314	204	350	-	175

CR 15


CR 15
50 Hz
ISO 9906:2012 Grade 3B
p [kPa]
H [m]
-17
-14
-12
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
Q [m³/h]
Q [l/s]
P2 [kW]
Eta [%]
P2
Eta
H [m]
NPSH [m]
2900 rpm
NPSH

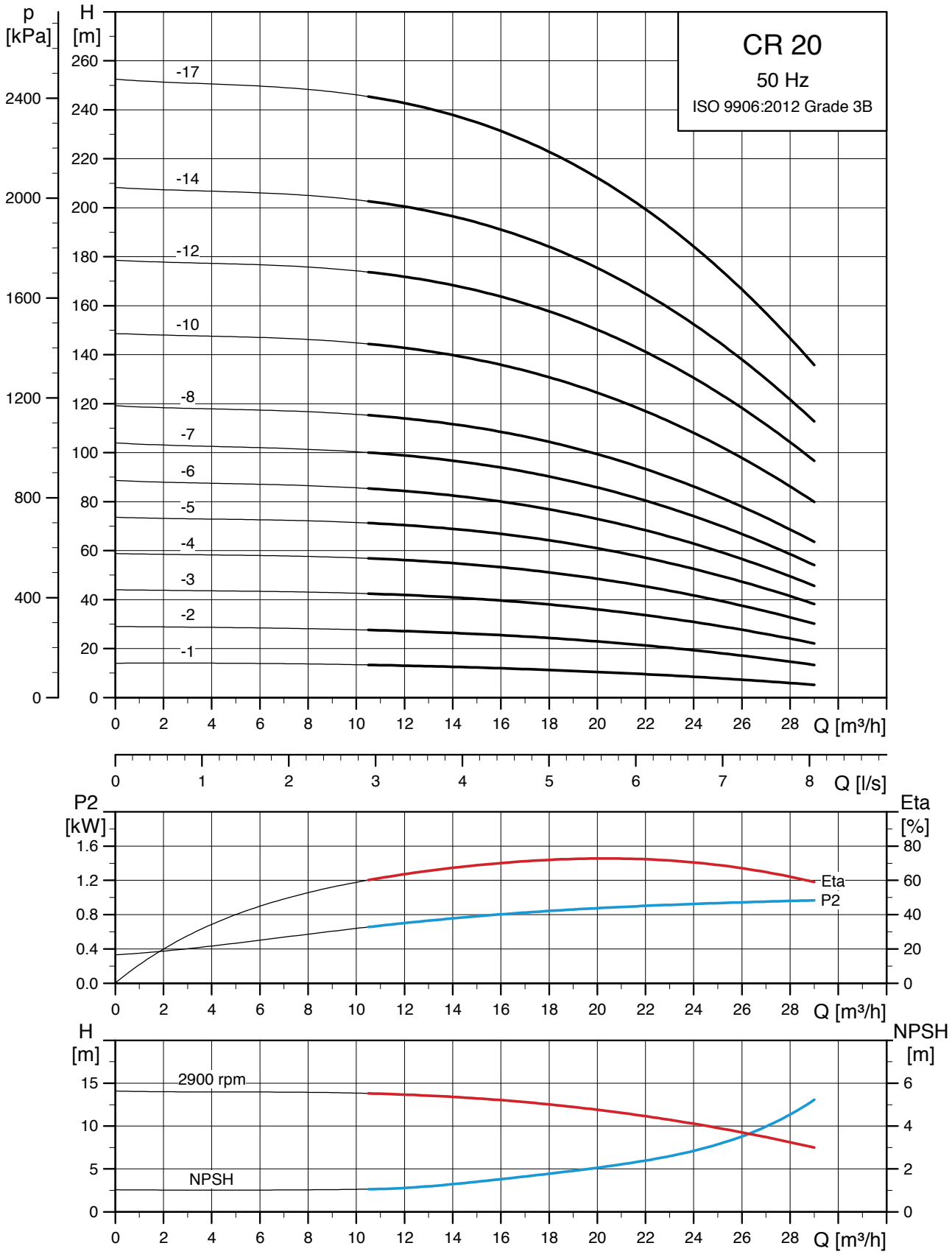
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR20- CRN20 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR20- CRN20



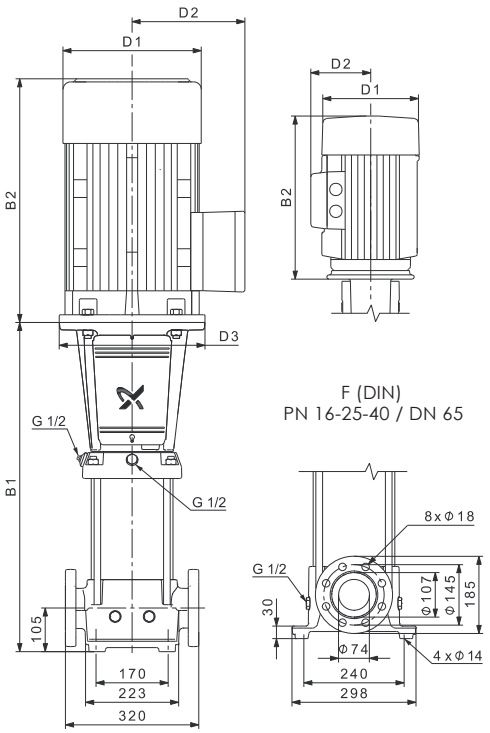
Dimensions and weights

Pump type	Motor P_2 [kW]	CR								
		Dimension [mm]							Net weight [kg]	
		Oval flange		DIN flange		D1	D2	D3	Oval flange	DIN flange
		B1	B1+B2	B1	B1+B2					
CR 20-1	1.10	400	651	400	651	141	109	-	41	42
CR 20-2	2.20	415	736	415	736	178	110	-	49	50
CR 20-3	4.00	465	837	465	837	220	134	-	65	66
CR 20-4	5.50	542	933	542	933	220	134	300	87	88
CR 20-5	5.50	587	978	587	978	220	134	300	89	90
CR 20-6	7.50	632	1011	632	1011	260	159	300	101	102
CR 20-7	7.50	677	1056	677	1056	260	159	300	103	103
CR 20-8	11.00	-	-	799	1270	314	204	350	-	146
CR 20-10	11.00	-	-	889	1360	314	204	350	-	149
CR 20-12	15.00	-	-	979	1450	314	204	350	-	166
CR 20-14	15.00	-	-	1069	1540	314	204	350	-	170
CR 20-17	18.50	-	-	1204	1719	314	204	350	-	188

CR 20


CR 20
50 Hz
ISO 9906:2012 Grade 3B
p [kPa]
H [m]
-17
-14
-12
-10
-8
-7
-6
-5
-4
-3
-2
-1
Q [m³/h]
Q [l/s]
P2 [kW]
Eta [%]
Eta
P2
H [m]
NPSH [m]
2900 rpm
NPSH

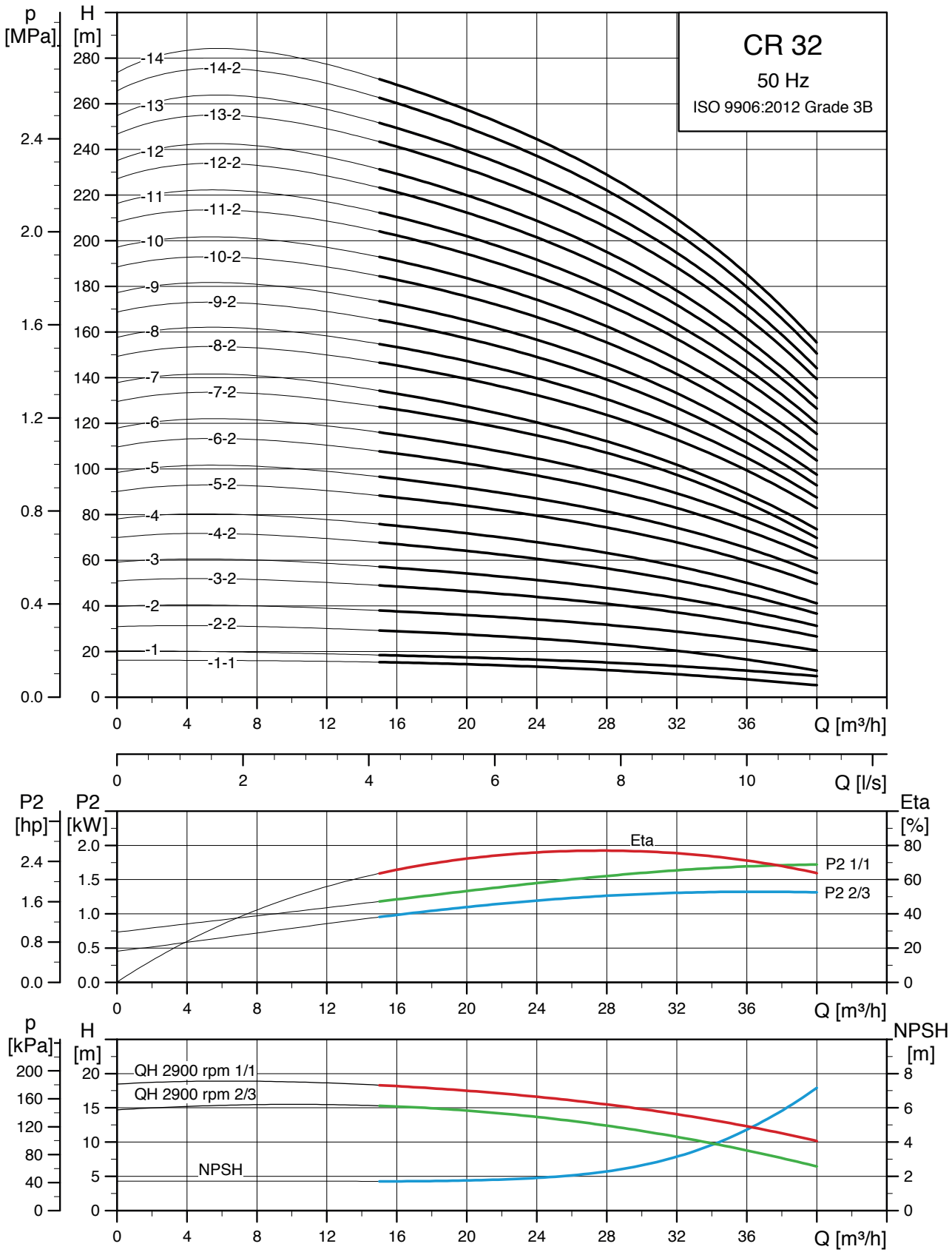
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR32- CRN32 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR32- CRN32



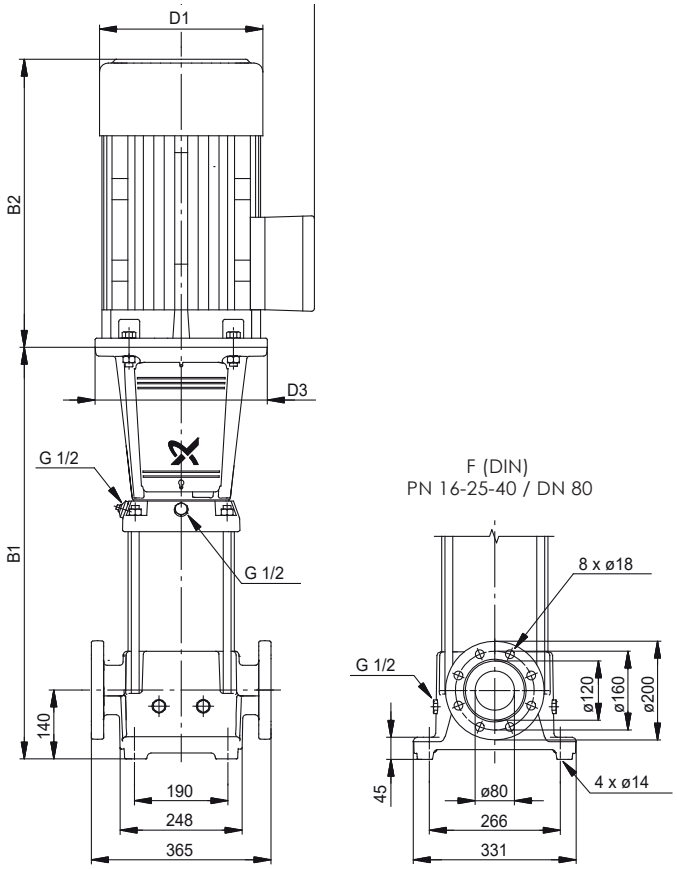
Dimensions and weights

Pump type	Motor P_2 [kW]	CR					
		Dimension [mm]					Net weight [kg]
		B1	B1+B2	D1	D2	D3	
CR 32-1-1	1.50	505	786	178	110	-	64
CR 32-1	2.20	505	826	178	110	-	64
CR 32-2-2	3.00	575	910	198	120	-	73
CR 32-2	4.00	575	947	220	134	-	82
CR 32-3-2	5.50	645	1036	220	134	300	96
CR 32-3	5.50	645	1036	220	134	300	96
CR 32-4-2	7.50	715	1094	260	159	300	110
CR 32-4	7.50	715	1094	260	159	300	111
CR 32-5-2	11.00	895	1366	314	204	350	158
CR 32-5	11.00	895	1366	314	204	350	158
CR 32-6-2	11.00	965	1436	314	204	350	161
CR 32-6	11.00	965	1436	314	204	350	161
CR 32-7-2	15.00	1035	1506	314	204	350	177
CR 32-7	15.00	1035	1506	314	204	350	177
CR 32-8-2	15.00	1105	1576	314	204	350	183
CR 32-8	15.00	1105	1576	314	204	350	183
CR 32-9-2	18.50	1175	1690	314	204	350	200
CR 32-9	18.50	1175	1690	314	204	350	200
CR 32-10-2	18.50	1245	1760	314	204	350	203
CR 32-10	18.50	1245	1760	314	204	350	203
CR 32-11-2	22.00	1315	1856	314	204	350	220
CR 32-11	22.00	1315	1856	314	204	350	220
CR 32-12-2	22.00	1385	1926	314	204	350	224
CR 32-12	22.00	1385	1926	314	204	350	224
CR 32-13-2	30.00	1455	2066	396	315	400	344
CR 32-13	30.00	1455	2066	396	315	400	344
CR 32-14-2	30.00	1525	2136	396	315	400	347
CR 32-14	30.00	1525	2136	396	315	400	347

CR 32


CR 32
50 Hz
ISO 9906:2012 Grade 3B
p [MPa]
H [m]
-14
-14-2
-13
-13-2
-12
-12-2
-11
-11-2
-10
-10-2
-9
-9-2
-8
-8-2
-7
-7-2
-6
-6-2
-5
-5-2
-4
-4-2
-3
-3-2
-2
-2-2
-1
-1-1
Q [m³/h]
Q [l/s]
P2 [hp]
P2 [kW]
Eta [%]
Eta
P2 1/1
P2 2/3
p [kPa]
H [m]
NPSH [m]
QH 2900 rpm 1/1
QH 2900 rpm 2/3
NPSH

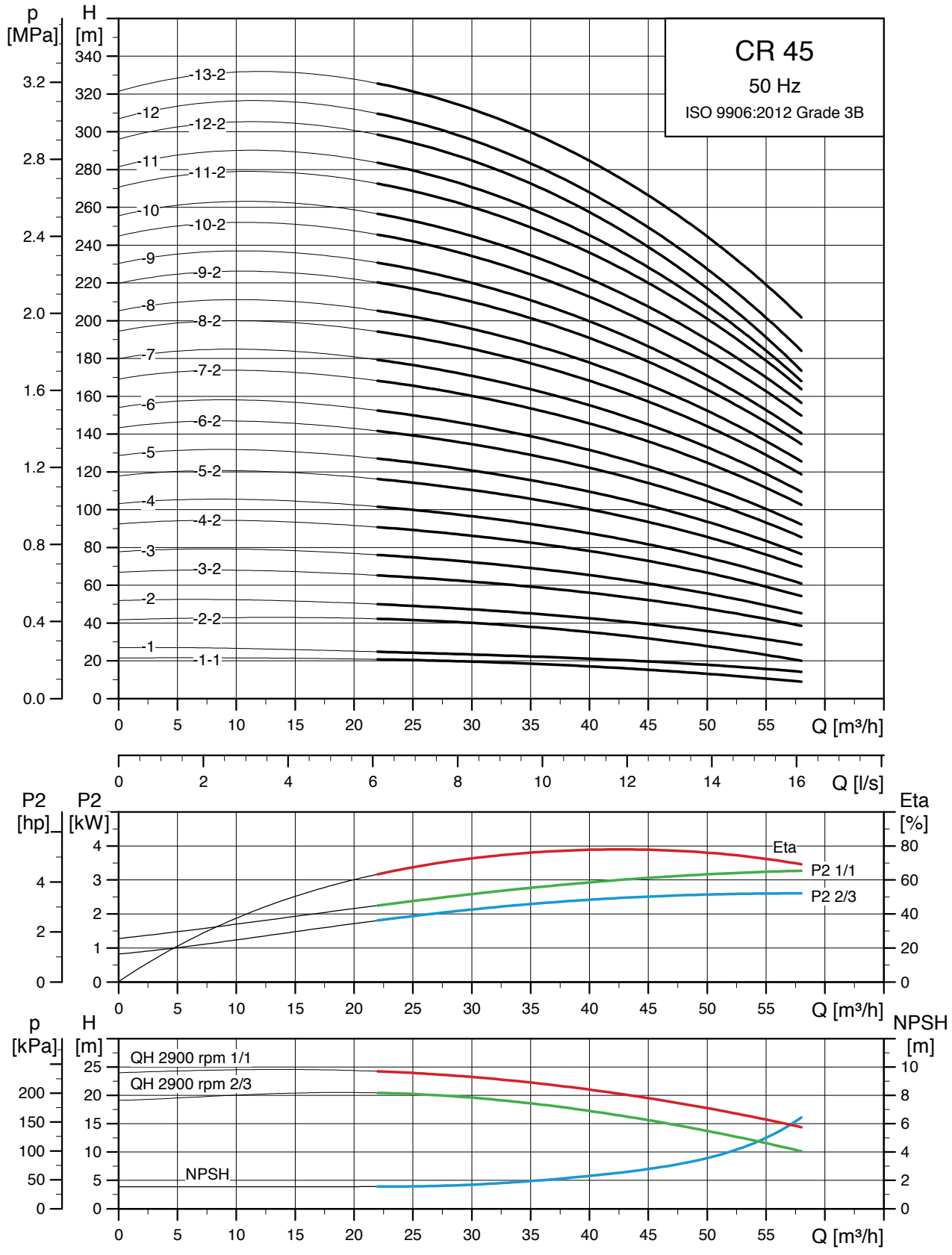
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR45- CRN45 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR45- CRN45



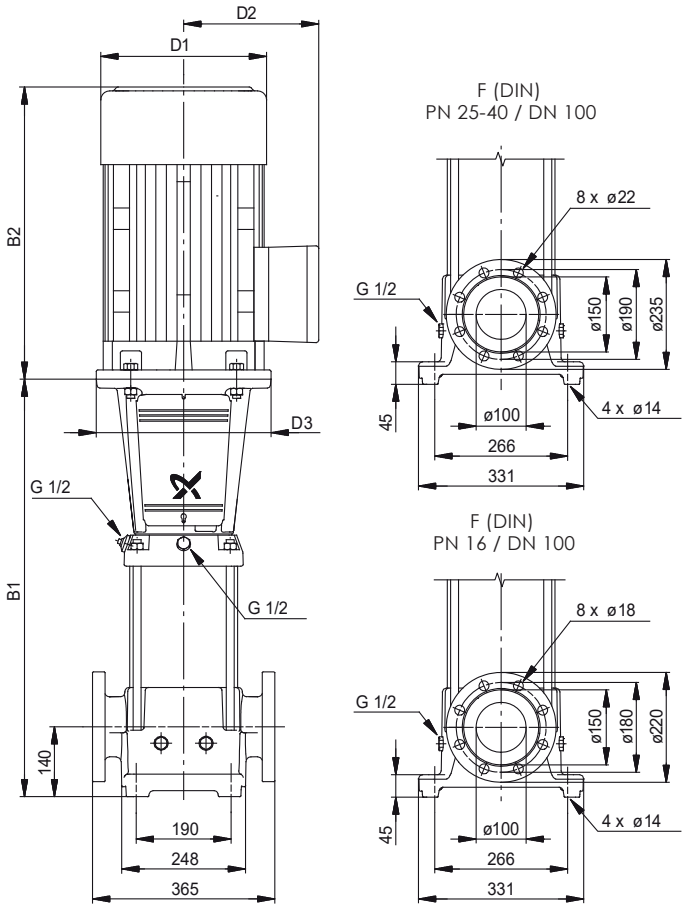
Dimensions and weights

Pump type	Motor P_2 [kW]	CR Dimension [mm] B1	B1+B2	D1	D2	D3	Net weight [kg]
CR 45-1-1	3.00	559	894	198	120	-	80
CR 45-1	4.00	559	931	220	134	-	89
CR 45-2-2	5.50	639	1030	220	134	300	104
CR 45-2	7.50	639	1018	260	159	300	114
CR 45-3-2	11.00	829	1300	314	204	350	163
CR 45-3	11.00	829	1300	314	204	350	163
CR 45-4-2	15.00	909	1380	314	204	350	180
CR 45-4	15.00	909	1380	314	204	350	180
CR 45-5-2	18.50	989	1504	314	204	350	197
CR 45-5	18.50	989	1504	314	204	350	197
CR 45-6-2	22.00	1069	1610	314	204	350	217
CR 45-6	22.00	1069	1610	314	204	350	217
CR 45-7-2	30.00	1149	1760	396	315	400	339
CR 45-7	30.00	1149	1760	396	315	400	339
CR 45-8-2	30.00	1229	1840	396	315	400	343
CR 45-8	30.00	1229	1840	396	315	400	343
CR 45-9-2	30.00	1309	1920	396	315	400	347
CR 45-9	37.00	1309	1945	396	315	400	362
CR 45-10-2	37.00	1389	2025	396	315	400	367
CR 45-10	37.00	1389	2025	396	315	400	367
CR 45-11-2	45.00	1469	2177	439	338	450	455
CR 45-11	45.00	1469	2177	439	338	450	455
CR 45-12-2	45.00	1549	2257	439	338	450	460
CR 45-12	45.00	1549	2257	439	338	450	460
CR 45-13-2	45.00	1629	2337	439	338	450	464

CR 45


CR 45
50 Hz
ISO 9906:2012 Grade 3B
p [MPa]
H [m]
-13-2
-12
-12-2
-11
-11-2
-10
-10-2
-9
-9-2
-8
-8-2
-7
-7-2
-6
-6-2
-5
-5-2
-4
-4-2
-3
-3-2
-2
-2-2
-1
-1-1
Q [m³/h]
Q [l/s]
P2 [hp]
P2 [kW]
Eta [%]
Eta
P2 1/1
P2 2/3
p [kPa]
H [m]
QH 2900 rpm 1/1
QH 2900 rpm 2/3
NPSH
NPSH [m]

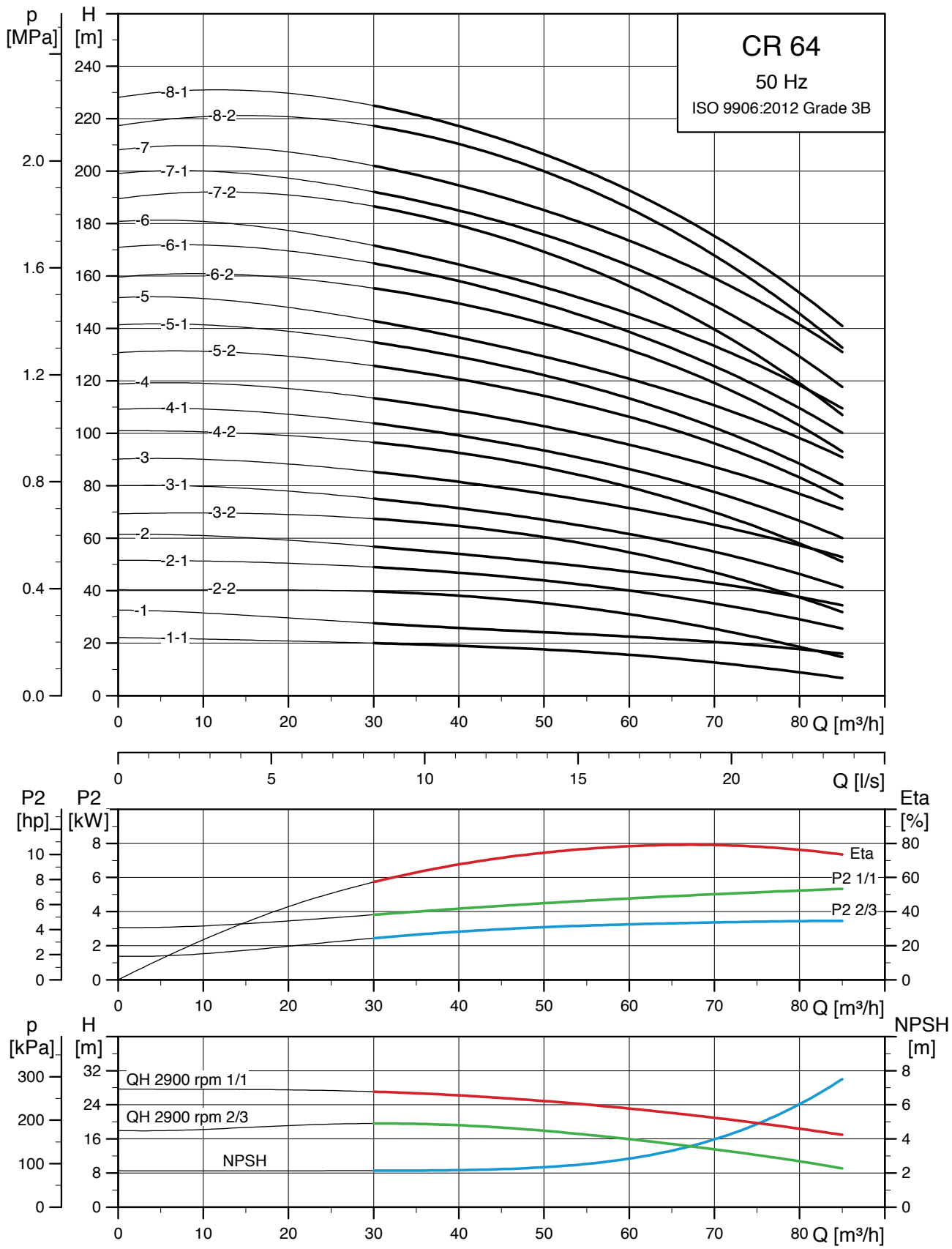
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR64- CRN64 / VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR64- CRN64



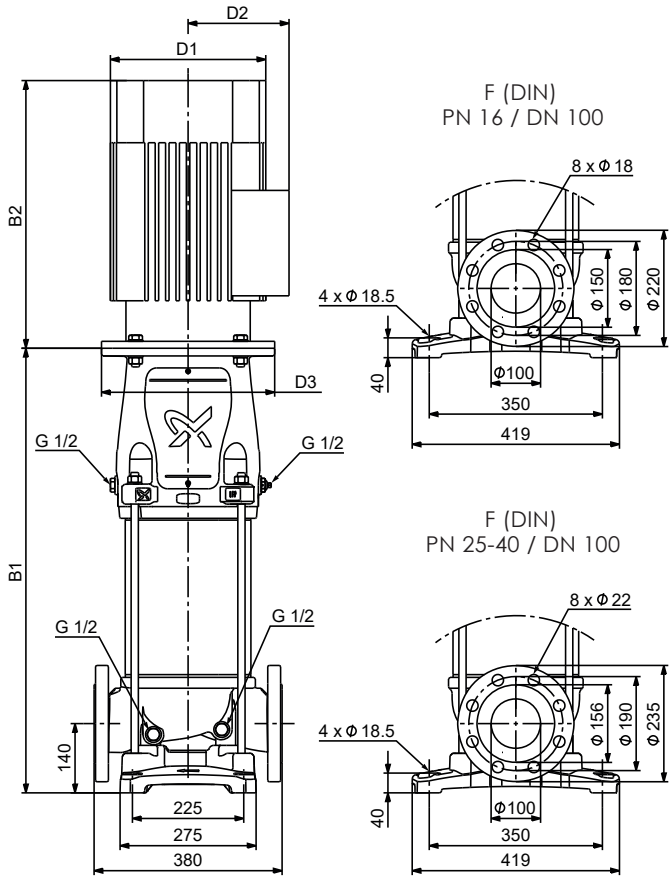
Dimensions and weights

Pump type	Motor P_2 [kW]	CR					
		Dimension [mm]					Net weight [kg]
		B1	B1+B2	D1	D2	D3	
CR 64-1-1	4.00	561	933	220	134	-	91
CR 64-1	5.50	561	952	220	134	300	102
CR 64-2-2	7.50	644	1023	260	159	300	117
CR 64-2-1	11.00	754	1225	314	204	350	162
CR 64-2	11.00	754	1225	314	204	350	162
CR 64-3-2	15.00	836	1307	314	204	350	180
CR 64-3-1	15.00	836	1307	314	204	350	180
CR 64-3	18.50	836	1351	314	204	350	193
CR 64-4-2	18.50	919	1434	314	204	350	197
CR 64-4-1	22.00	919	1460	314	204	350	211
CR 64-4	22.00	919	1460	314	204	350	211
CR 64-5-2	30.00	1001	1612	396	315	400	333
CR 64-5-1	30.00	1001	1612	396	315	400	333
CR 64-5	30.00	1001	1612	396	315	400	333
CR 64-6-2	30.00	1084	1695	396	315	400	339
CR 64-6-1	37.00	1084	1720	396	315	400	354
CR 64-6	37.00	1084	1720	396	315	400	354
CR 64-7-2	37.00	1166	1802	396	315	400	359
CR 64-7-1	37.00	1166	1802	396	315	400	359
CR 64-7	45.00	1166	1874	439	338	450	443
CR 64-8-2	45.00	1249	1957	439	338	450	448
CR 64-8-1	45.00	1249	1957	439	338	450	448

CR 64


CR 64
50 Hz
ISO 9906:2012 Grade 3B
p [MPa]
H [m]
8-1
8-2
7
7-1
7-2
6
6-1
6-2
5
5-1
5-2
4
4-1
4-2
3
3-1
3-2
2
2-1
2-2
1
1-1
Q [m³/h]
Q [l/s]
P2 [hp]
P2 [kW]
Eta [%]
Eta
P2 1/1
P2 2/3
p [kPa]
H [m]
NPSH [m]
QH 2900 rpm 1/1
QH 2900 rpm 2/3
NPSH

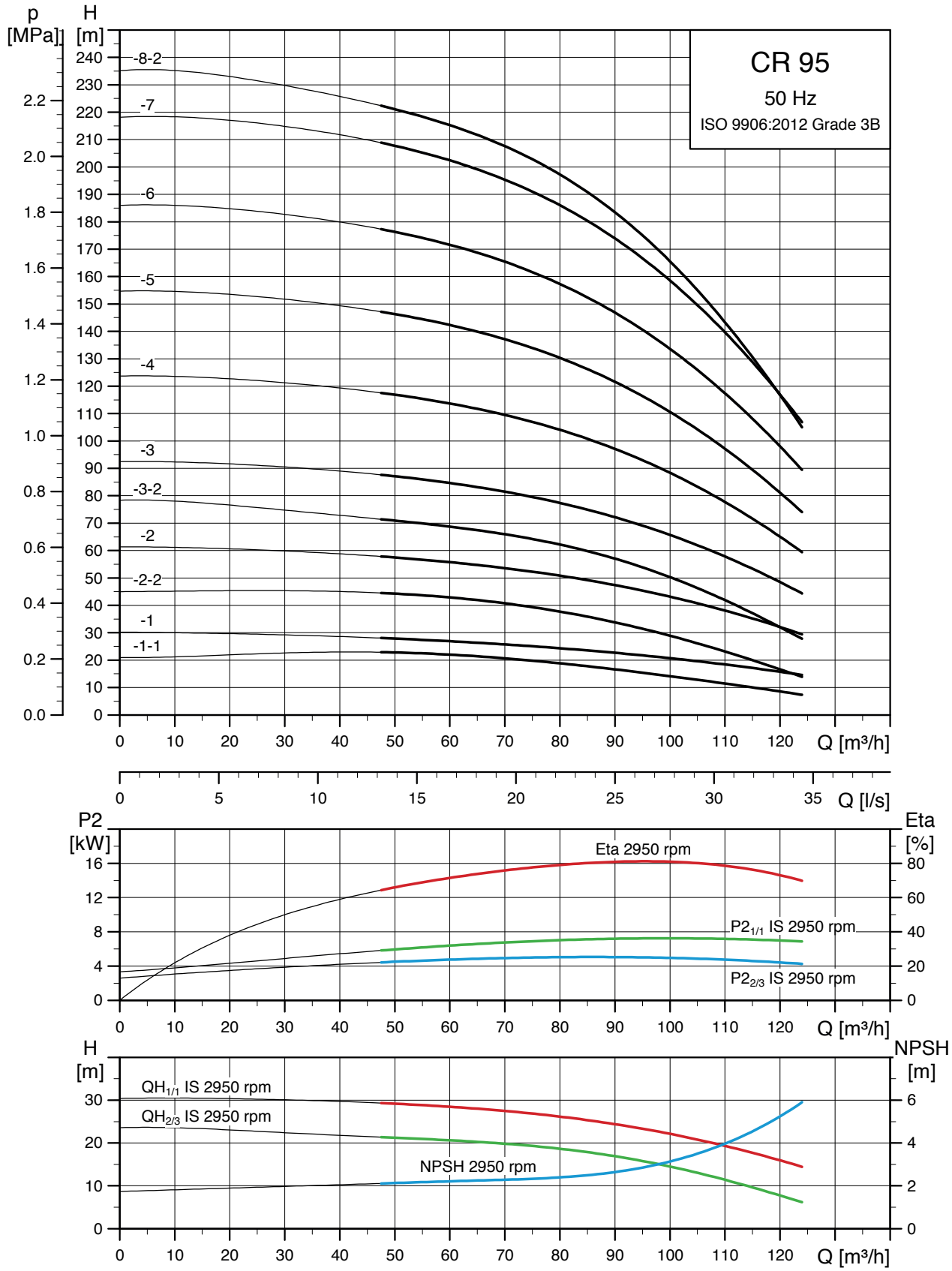
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR95- CRN95/ VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR95- CRN95



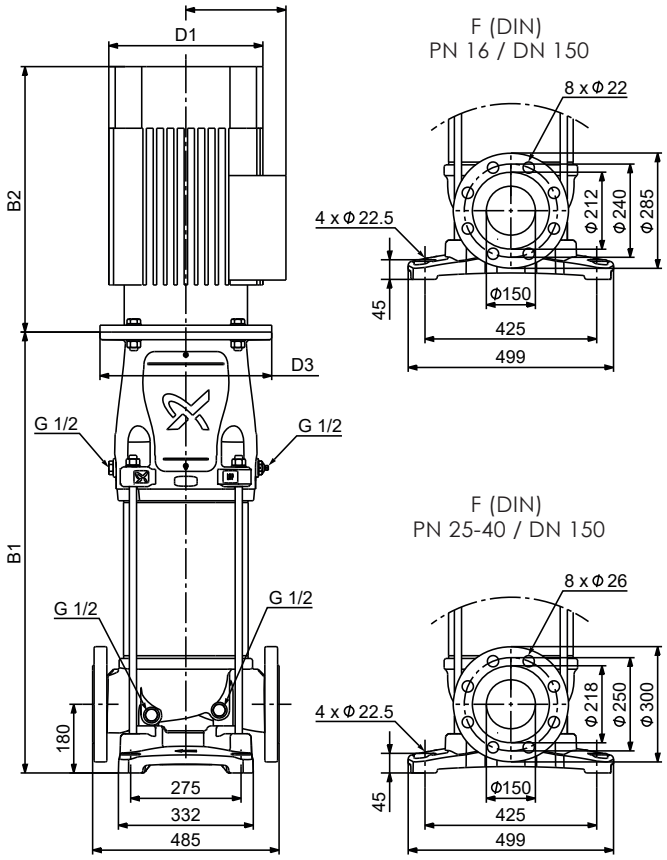
Dimensions and weights

Pump type	Motor P_2 [kW]	CR Dimension [mm]					Net weight [kg]
		B1	B1+B2	D1	D2	D3	
CR 95-1-1	5.5	689	1080	220	134	300	125
CR 95-1	7.5	689	1068	260	159	300	135
CR 95-2-2	11	795	1266	314	204	350	182
CR 95-2	15	795	1266	314	204	350	193
CR 95-3-2	18.5	900	1415	314	204	350	212
CR 95-3	22	900	1441	314	204	350	227
CR 95-4	30	1009	1620	396	315	400	349
CR 95-5	37	1114	1750	396	315	400	380
CR 95-6	45	1238	1946	449	338	450	462
CR 95-7	55	1342	2089	497	410	550	562
CR 95-8-2	55	1446	2193	497	410	550	568

CR 95


CR 95
50 Hz
ISO 9906:2012 Grade 3B
p [MPa]
H [m]
-8-2
-7
-6
-5
-4
-3
-3-2
-2
-2-2
-1
-1-1
Q [m³/h]
Q [l/s]
P2 [kW]
Eta [%]
Eta 2950 rpm
P2$_{1/1}$ IS 2950 rpm
P2$_{2/3}$ IS 2950 rpm
H [m]
NPSH [m]
QH$_{1/1}$ IS 2950 rpm
QH$_{2/3}$ IS 2950 rpm
NPSH 2950 rpm

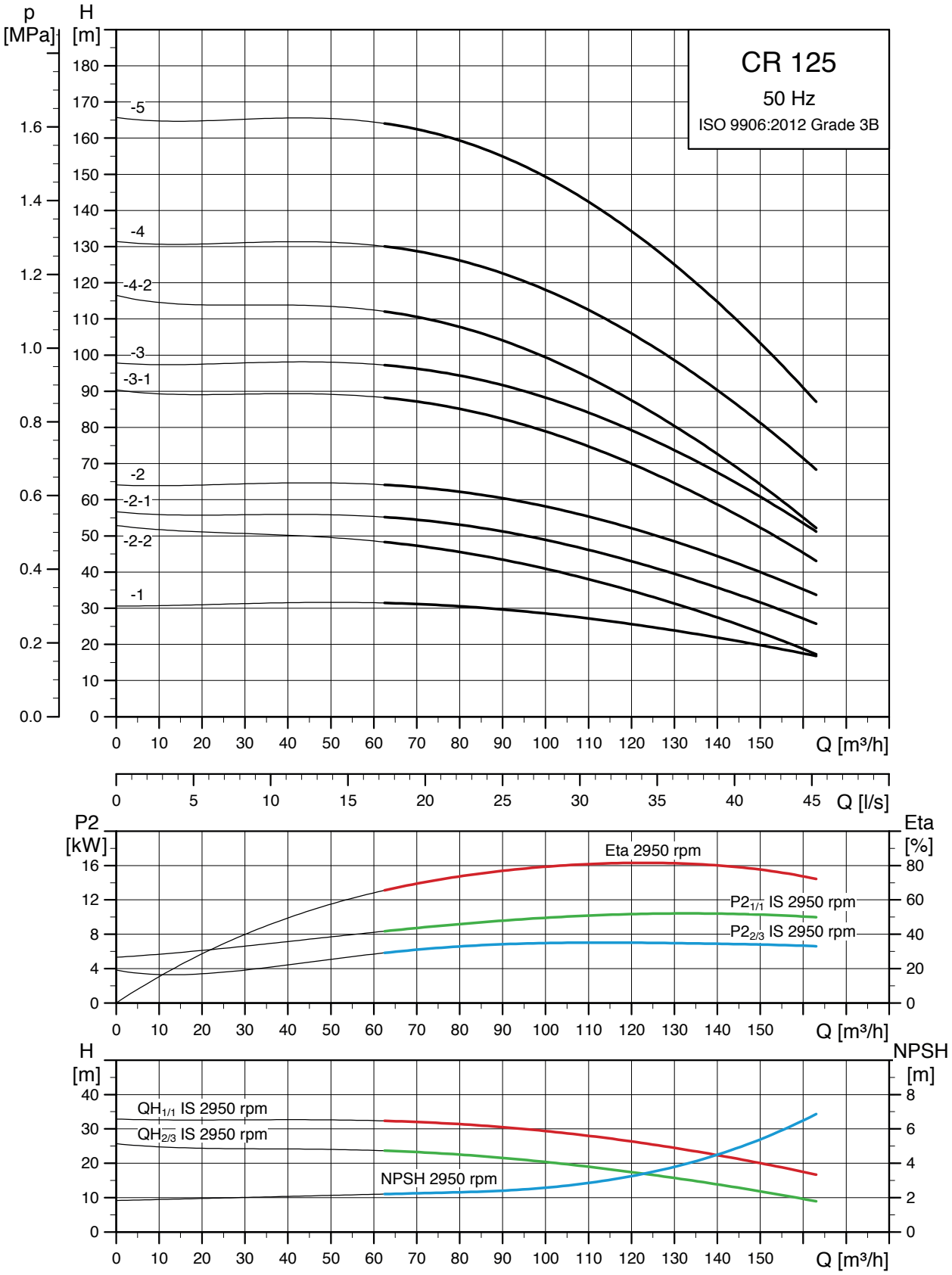
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR125- CRN125/ VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR125- CRN125



Dimensions and weights

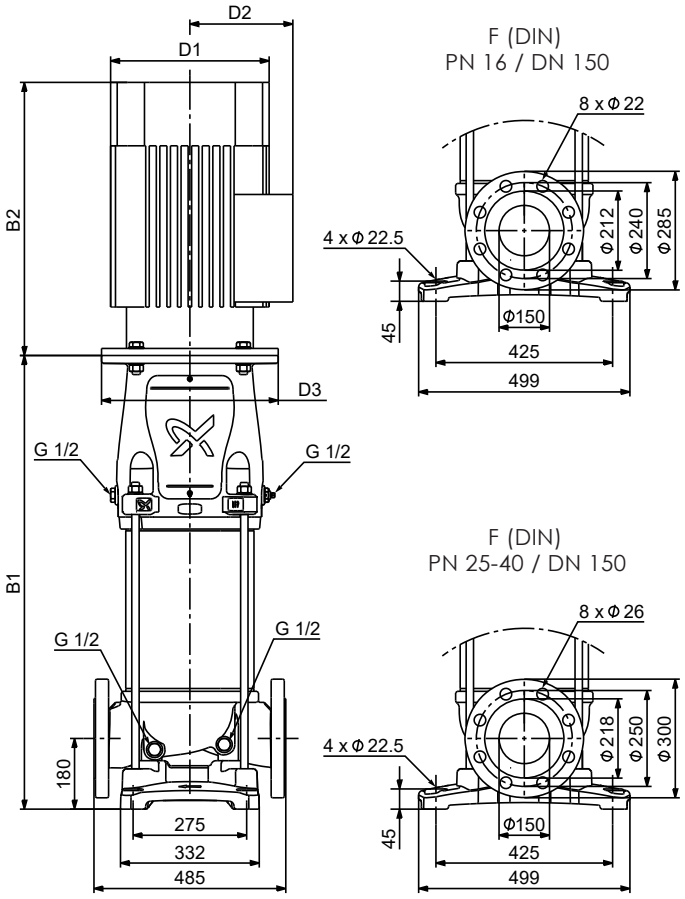
Pump type	Motor P_2 [kW]	CR					Net weight [kg]
		Dimension [mm]					
		B1	B1+B2	D1	D2	D3	
CR 125-1	11	783	1254	314	204	350	213
CR 125-2-2	15	905	1376	314	204	350	235
CR 125-2-1	18.5	905	1420	314	204	350	248
CR 125-2	22	905	1446	314	204	350	263
CR 125-3-1	30	1029	1640	396	315	400	390
CR 125-3	37	1029	1665	396	315	400	415
CR 125-4-2	37	1151	1787	396	315	400	425
CR 125-4	45	1174	1882	449	338	450	501
CR 125-5	55	1294	2041	497	410	550	603

CR 125



The maximum pump efficiency (ETA) is based on a three-stage pump.

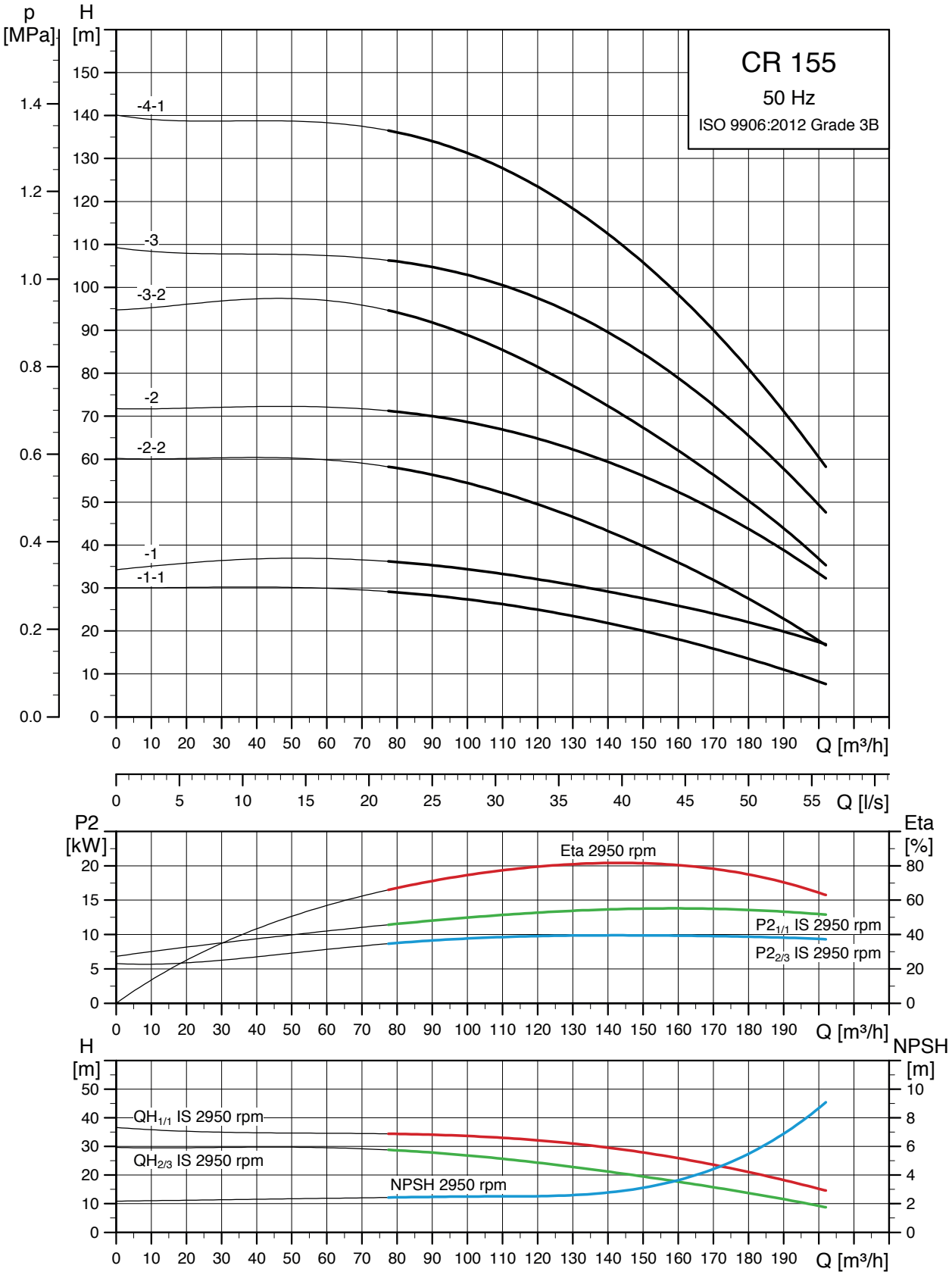
POMPE MULTISTADIO CENTRIFUGHE VERICALI CR155- CRN155/ VERTICAL MULTISTAGE CENTRIFUGAL PUMPS SERIES CR155- CRN155



Dimensions and weights

Pump type	Motor P_2 [kW]	CR					
		Dimension [mm]					Net weight [kg]
		B1	B1+B2	D1	D2	D3	
CR 155-1-1	11	783	1254	314	204	350	214
CR 155-1	15	783	1254	314	204	350	226
CR 155-2-2	22	905	1446	314	204	350	264
CR 155-2	30	907	1518	396	315	400	381
CR 155-3-2	37	1029	1665	396	315	400	416
CR 155-3	45	1052	1760	449	338	450	492
CR 155-4-1	55	1172	1919	497	410	550	594

CR 155



Preliminary performance curves.
The maximum pump efficiency (ETA) is calculated and based on a three-stage pump.