

HEMMEN H- PUMP PRODUCT OVERVIEW



SKID/TOMBSTONE/CLAMPS

- FABRICATED/PAINTED LOCALLY LONGVIEW PER HEMMEN ENGINEERING
- CLAMPS: CAST AND BORED TO MEET PUMP OEM BARREL OD: 8.75", 7.25", 7.00", 6.75" . STD OEM COATING/PAINT
- MOUNT HARDWARE IS GALVANIZED STEEL
- TOMBSTONE: BOLTED AND SHIMMED TO SKID. MATCHES REDA G3A TC/ADAPTER SPOOL BOLT PATTERN
- SKIDS: CURRENTLY HAVE MD 6-9 CLAMP SKID FOR 500HP (ANEMA) AND LARGER DESIGNS
 - LD SKID FOR SMALLER HP/PUMPS UNDER DEVELOPMENT
 - ADOPTING BORETS CLOSE COUPLED (NO TC) DESIGN FOR 100 HP AND SMALLER SIZES
 - CAN RETROFIT/REDRESS/REPURPOSE EXISTING SKID TO MATCH NEW HYDRAULICS AND PUMP OEM BARRELS



SKID/TOMBSTONE/CLAMPS

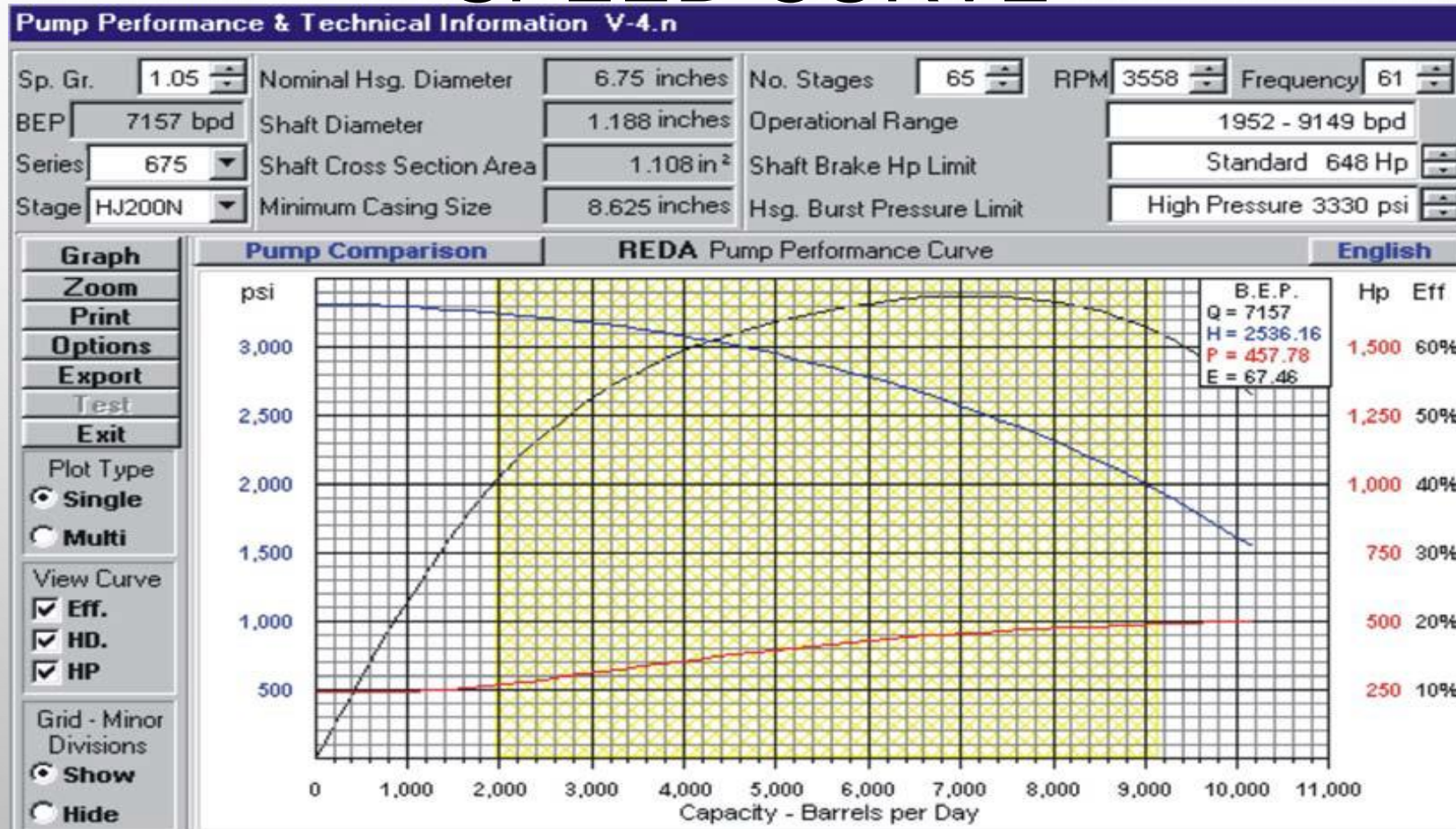
PUMP BARRELS (FOR SWD)/SPLINE COUPLINGS/ORING KITS

- CURRENTLY ABLE TO SOURCE FOLLOWING OEM PUMP BARRELS (COMPRESSION BUILD)
 - SUMMIT –HALLIBURTON
 - BORETS
 - HOSS
 - TWO HYDRAULIC STAGE VERSIONS: CURRENT CL DUPE (ROTATE REVERSE), WOODS DUPE (AVAILA ABLE MIDYEAR 2019)
- ALL PUMP DESIGNS VIA INTELLIQUIP SOFTWARE (CURVES) FOR APPLICATION SPECIFIC CONDITIONS (FLOW, PRESSURE, HP, THRUST)
- ALL PUMP COMPRESSION BUILT
- ALL MATERIALS SUITABLE FOR SALT WATER DISPOSAL APPS
 - FUTURE APPLICATIONS TO PURSUE: CRUDE, AMINE, NGL AND MINE DEWATERING/WATER IMPOUNDMENT FOR FRACKING
- CAN RETROFIT EXISTING SKIDS FOR DIFFERENT OEM BARRELS
- TYPICAL LEADTIME FROM OEM'S: HEMMEN STOCK TO 4 WKS OR LESS
- BARREL REPAIRS GO BACK TO OEM'S
 - 2-4 WKS TYPICAL LEADTIME (IF REPAIRABLE)
- SPARE BARRELS IN INVENTORY
 - FILL WITH PRESERVATIVE TO KEEP FROM RUSTING
 - ROTATE IDLE PUMP SHAFTS PERIODICALLY
- ORING KITS: HSN, AFLAS FOR VARIOUS SIZE/SERIES PUMPS AND OTHER CONNECTIONS.
- PUMP TO PUMP AND PUMP TO TC SPLINE COUPLINGS (MONEL, INCONEL AND SS) FOR VARIOUS SHAFT SIZES/HP RATINGS AND FLUID COMPATIBILITIES
 - SOURCING FROM PUMP OEM'S/3RD PARTY VENDOR

PUMP BARRELS (FOR SWD)/CAPABILITIES AND HYDRAULIC COVERAGE

- UNITS INSTALLED: 500+
- FLOWS: 50 GPM TO 1800 GPM
- INTAKE PRESSURE: UP TO 50-1,500 PSIG (HIGHER POSSIBLE UPON SPECIAL REQUEST)
- DISCH PRESSURE: UP TO 5,00 PSIG
- HP: 25HP TO 2000HP
- THRUST: UP TO 24,000 LB
- TEMPERATURES: UP TO 220F

PUMP BARRELS (FOR SWD)/TYPICAL SINGLE SPEED CURVE



CENTRIFUGAL PUMPS

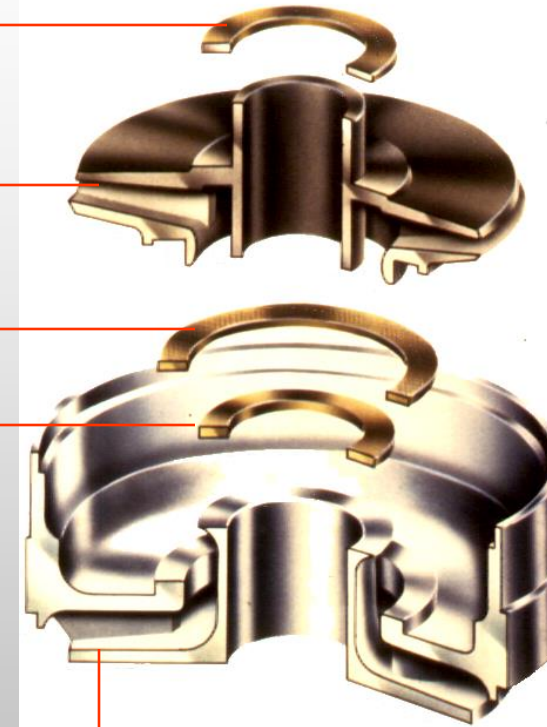
EACH "STAGE" CONSISTS OF AN IMPELLER AND A DIFFUSER. AGAIN, THE IMPELLER TAKES THE FLUID AND IMPARTS KINETIC ENERGY TO IT. THE DIFFUSER CONVERTS THIS KINETIC ENERGY INTO POTENTIAL ENERGY (HEAD).

Thrust Washer

Impeller

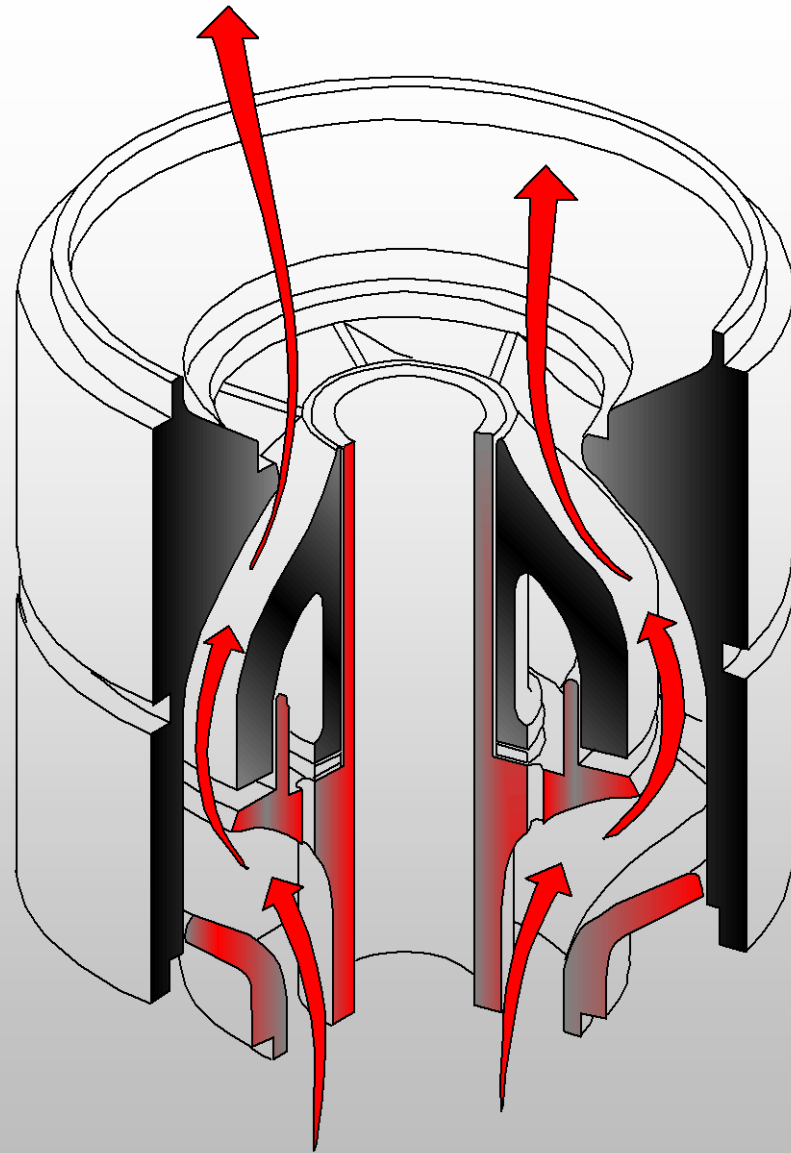
Thrust Washer

Diffuser

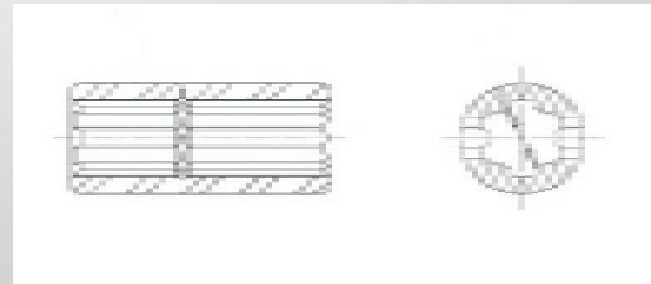
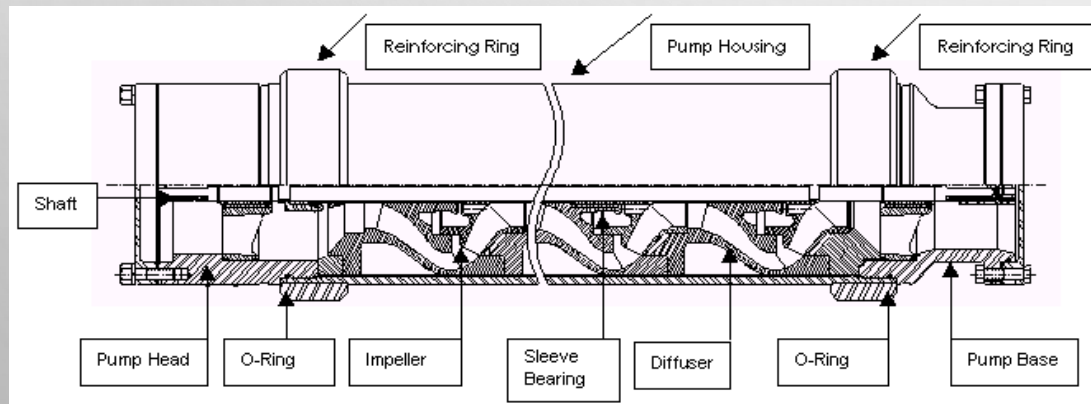


CENTRIFUGAL PUMPS

TYPICAL FLUID FLOW PATH
IN A
"MIXED FLOW" STAGE.

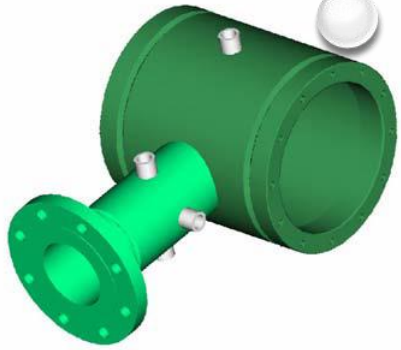


PUMP BARRELS/SPLINE COUPLINGS

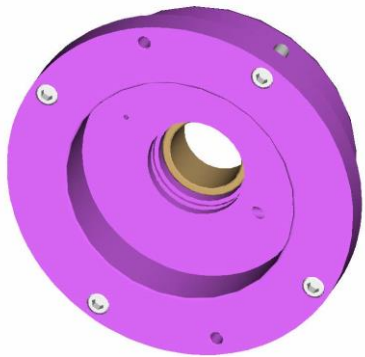


TC/ADAPTER SPOOL, INTAKE AND SEAL CHAMBERS

- TC IS DUPLICATE REDA HPS G3A-2B AND ADAPTER SPOOL (ALSO: INTAKE, AND NON CARTRIDGE MECH SEAL CHAMBERS)
 - FUTURE DESIGNS FOR CARTRIDGE SINGLE/TANDEM SEALS CONFIGURATIONS WITH SEAL CHAMBER DESIGNED TO ACCOMMODATE
 - 17-4PH SS SHAFT GOOD TO 1750 HP
 - INPRO LABYRINTH OIL SEALS
 - INTERNAL STANDTUBE TO PREVENT OIL OVERFILLING
 - 1.5" PUMP SPLINE END WITH 2, 3 AND 4 BEARING DESIGNS TO ALLOW FOR 24K LB HYDRAULIC THRUST CAPABILITIES
 - CYLINDRICAL BORE AND KEY ON MOTOR END
 - RATINGS:
 - 2B LESS COOLER: 8 K LB THRUST
 - 2B WITH COOLER: 12K LB THRUST
 - 3B WITH COOLER: 18K LB THUST
 - 4B WITH COOLER: 24K LB THRUST
 - OIL IS MOBIL SYNTHETIC
 - SIDE OR TOP MOUNTED VIBRATION TRANSMITTER (STI OR METRIX)
 - SIDE PORT OIL TEMP MOUNTING PROVISIONS (RTD TEMP DEVICE WITH SS THERMOWELL)
- INTAKES: FABRICATED 316SS FOR 6" 150# RF DESIGN
 - TAPS (PLUGGED THREADED O-LETS) FOR VENT AND DRAIN AND PRESSURE INSTRUMENT CONNECTIONS
 - ROTATABLE ORIENTATION
- 316SS MACHINED BAR STOCK SEAL CHAMBERS ACCOMMODATE NON CARTRIDGE SINGLE BELLOWS PUSHER SEALS (LESS FLUSH-PLAN 02 DEAD ENDED SEAL CHAMBER)

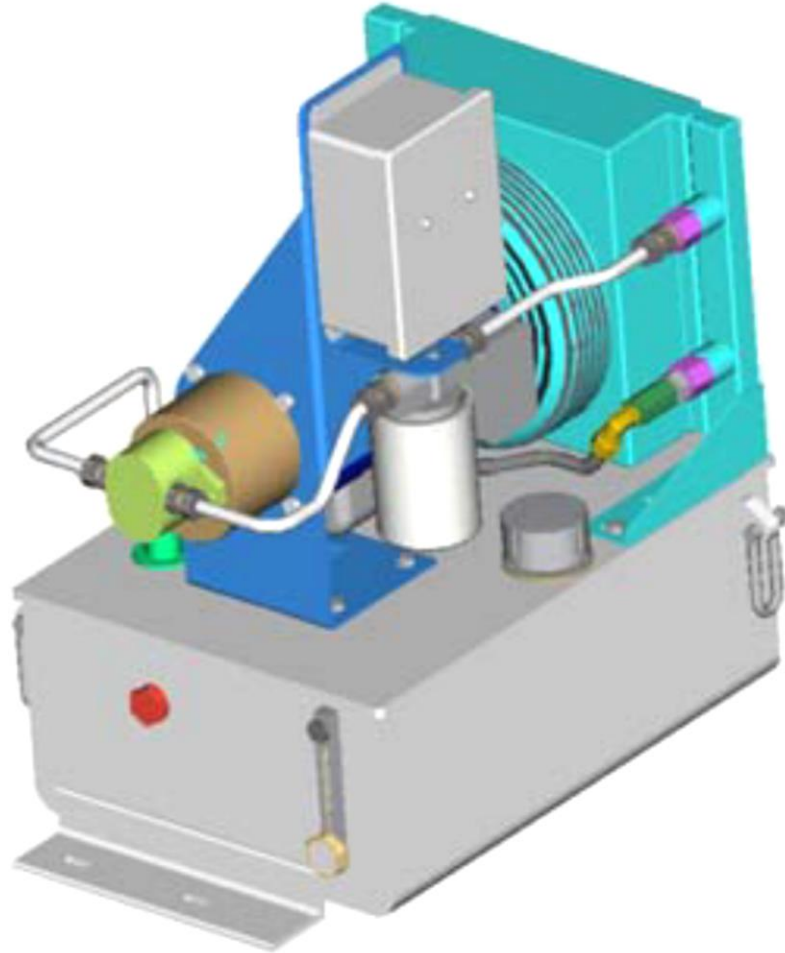


TC/ADAPTER SPOOL, INTAKE AND SEAL CHAMBERS



TC OIL COOLER

- CURRENT IS DUPLICATE REDA HPS COOLER CONFIGURATION
- INCLUDED INTERCONNECTING HOSES
- ADDING IMMERSION HEATER PROVISIONS (SIDE, 2" THREADED PLUGGED)
- SKID SIDE MOUNTING BRACKET
- COOLER REQUIRED FOR 8K LB THRUST AND ABOVE
- FIVE US GAL CAPACITY STAINLESS STEEL RESERVOIR.
- INTEGRAL 1/2-HP DOUBLE-ENDED MOTOR (DRIVES COOLER FAN AND PUMP) WIRED TO JUNCTION BOX (XP)
- OIL LEVEL SWITCH. PRESSURE SWITCH OPTIONAL
- ONBOARD "SPIN-ON" FILTER. 25 MICRON
- FILLER/BREATHING PORT.
- XP AND NON-HAZARDOUS, 50/60 HZ, SINGLE-PHASE AND THREE-PHASE AVAILABLE.
- 25 PSI BYPASS PRESSURE LOOP.
- COMPACT OVERALL DIMENSIONS —25 1/8 IN.(L) X 17 IN.(W) X 23 3/8 IN. (H).
- INTEGRAL SIGHT GLASS/TEMPERATURE GAUGE.
- CLIENT TO FIELD WIRE MOTOR AND LEVEL SWITCH

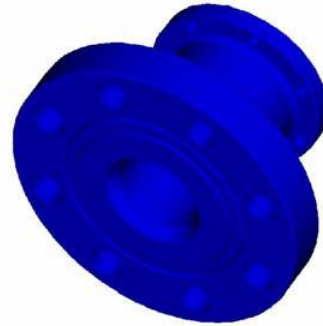
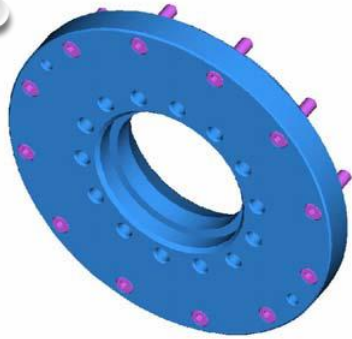


TC OIL
COOLER

INTAKE ADAPTER/DISCHARGE FLANGE HEAD ASSEMBLIES

- SS INTAKE ADAPTERS FOR 538/675/700/725/862/875 SERIES TO MATCH DIFFERENT PUMP OEM BARRELS BASE TO HEMMEN INTAKE BOLT PATTERNS
- 316SS DISCHARGE FLANGE ASSEMBLIES
 - 4" 1500/2500# RTJ SS, BY SERIES
 - BOLTED TO PUMP HEAD VIA MONEL OR SS FASTENERS
- FUTURE CONSIDERATIONS FOR DIFFERENT RATINGS AND CS MATERIAL FOR CRUDE, NGL AND AMINE APPS
 - REQUIRES NEW DESIGNS (600#/900#/1500#/2500#) FOR BOTH INTAKE AND DISCHARGES
 - RF AND RTJ FACING

INTAKE ADAPTER/DISCHARGE FLANGE HEAD ASSEMBLIES



ANSI B16.5 Flange Rating	Carbon Steel (ASTM # A105) Carbon Steel (ASTM# A4130)			316L SS 410SS-13 Chrm		
	Max Allowable Working Pressure (MAWP) (PSIG), -20F to 100F	Max Allowable Working Pressure (MAWP) (PSIG), 100F to 200F	Max Hydrostatic Test Pressure (PSIG) 1.5 x MAWP (30 Min Water)	Max Allowable Working Pressure (MAWP) (PSIG), -20F to 100F	Max Allowable Working Pressure (MAWP) (PSIG), 100F to 200F	Max Hydrostatic Test Pressure (PSIG) 1.5 x MAWP (30 Min Water)
150	285	250	450	230	190	350
300	740	675	1125	600	500	900
600	1480	1350	2225	1200	1000	1800
900	2220	2020	3350	1800	1500	2700
1500	3705	3375	5575	3000	2500	3600
2500	6170	5600	9255	6000	5225	9000

CMS-00 Rev AY Reference:

CS (A105) Material Conforms to SLB Material Standard: CMS-Z2TMJ.0

CS (A4130) Material Conforms to SLB Material Standard: MDS-2

316L SS Material Conforms to SLB Material Standard: CMS-Z4EGE.0

410 SS Material Conforms to SLB Material Standard: CMS-Z44NA.0

1) Above Chart Applies to All HPS Intakes, Discharges and Drop Out Spools

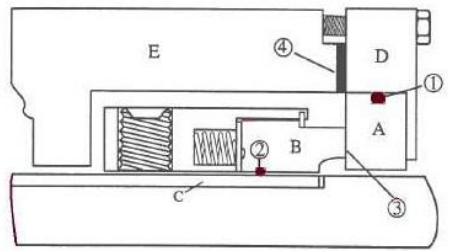
2) Reference GEMS Document 100098795 (Latest Revision) for Hydro Test Procedures

3) Gray Loc Discharge Adapters MAWP/Test Pressures Not Covered Under this Rating Chart. Consult HPS Engr

MECHANICAL SEALS AND FLUSH, SEAL CHAMBERS

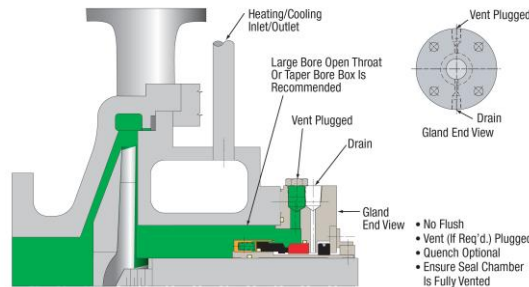
- DUPLICATE SS REDA NON CARTRIDGE (LOW AND HIGH PRESSURE VERSIONS) AND CARTRIDGE SEAL CHAMBERS.
- ALL SEALS SEAL AGAINST INLET PRESSURE. 1 SEAL REQUIRED PER SKID ASSEMBLY
- MECH SEAL OEM CHOICES : FLEX A SEAL, CHAMPION, APEX, FSI
- FOR SWD:
 - NON CARTRIDGE BELLOWS/PUSHER SINGLE SEALS LESS FLUSH ARE USED. A BALANCED DESIGN BE REQUIRED ABOVE 150 PSIG SUCTION PRESSURES. APEX OR CHAMPION MECHS SEALS ARE USED
- FOR CRUDE:
 - FLEX A SEAL SINGLE CARTRIDGE WITH PLAN 11/65 FLUSH
- FOR NGL:
 - FLEX A SEAL TANDEM CARTRIDGE WITH PLAN 11/52 FLUSH. HIGH PRESSURES MAY NEED ADDITIONAL SET SCREWS, DOG POINTS FOR SPLIT COLLARS (REQUIRES TC SHAFT NOD)
- FOR AMINE:
 - APE SINGLE NC OR CARTRIDGE (SINGLE OR TANDEM BASIS USER PREFERENCE): USE NO FLUSH, PLAN 11 OR PLAN 11/52. AFLAS ELASTOMERS REQUIRED. TC AND PUMP SHAFT AND SPLINE COUPLINGS NEED SS OR INCONEL
- HEMMEN MOUNTING PLAN 52 SEAL POTS ON EITHER SIDE OF THE SKID ON THE TC PLATE, OPPOSITE FROM INTAKE ORIENTATION (SIDE)
- HEMMEN TO PROVIDE SEAL FLUSH TUBING FOR ALL FLUSH PLANS. SS TUBING IS SEAMLESS WITH COMPRESSION FITTINGS
 - FOR PLAN 52/65 INSTRUMENTS: WIRING OF INSTRUMENTS TO ON SKID JBOX IS OPTIONAL
 - PLAN 65 HAS: LSH
 - PLAN 52 HAS: PSH WITH OPTIONAL LSL/LSH (24 VDC). 24VDC REQUIRES SEPARATE JUNCTION BOX
 - PLAN 65/52 OEMS: SEAL POTS INC OR FLEX A SEAL

MECHANICAL SEALS AND FLUSH, SEAL CHAMBERS

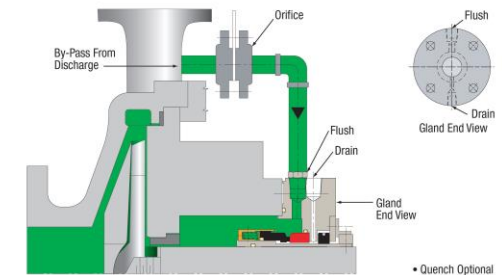


A Stationary face
B Rotating Face
C Sleeve
D Gland
E Stuffing box

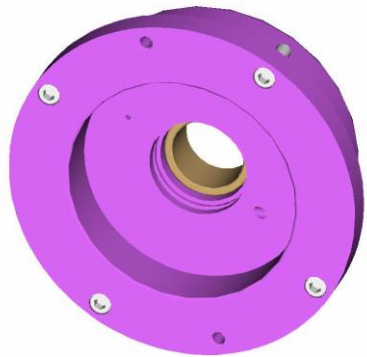
1. Stationary face O-ring
2. Dynamic O-ring
3. Sealing interface
4. Gland gasket



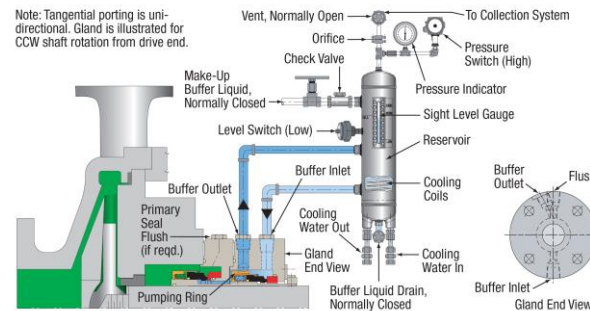
Plan 02 Single Seals



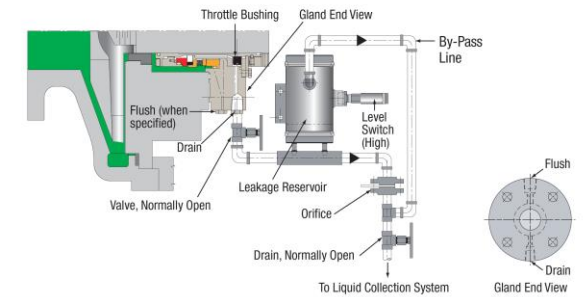
Plan 11 Single Seals



Note: Tangential porting is uni-directional. Gland is illustrated for CCW shaft rotation from drive end.



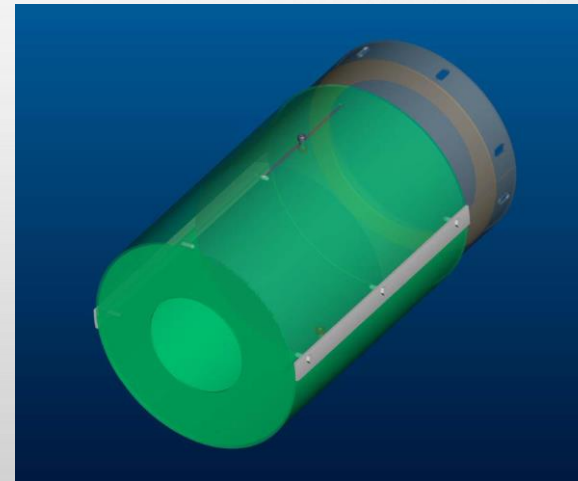
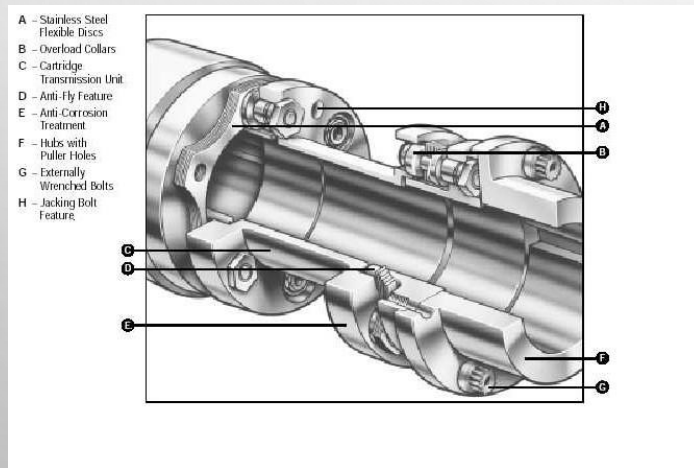
Plan 52 Dual Seals, Unpressurized



Plan 65 Single Seals

SPACER COUPLING/GUARD

- 7" SPACER SS DISC COUPLING TO MATCH SHAFT DIAMETERS FOR MOTOR AND TC (CYLINDRICAL BORE KEYED AND SET SCREW, SHRINK INTERFERENCE FIT).
- TELESCOPING NON SPARK GUARD (ALUMINUM OR PLASTIC)



MOTORS/VSD'S

- PREFERRED MOTOR: TOSHIBA OR TECO ANEMA TEFC FRAMES FOR 400-800 HP 2 POLE LV (460VAC) BALL BEARING GREASE LUBE.
 - MOST HPUMPS ARE SIZED FOR 2 POLE SPEED
 - OPTIONS FOR MOTORS INCLUDE: SH, RTD'S (BEARING/WINDING), T-STATS, INSULATED BEARINGS
 - OTHER MOTOR OEMS AND FRAME AND HP/VOLTAGE, BEARING TYPE (SLEEVE/OIL) AVAILABLE
 - VALIDATE ROTATION WITH PUMP BARREL OEM
- MOTOR BASE PLATE SLOTS/HOLES TO FIT ABOVE MOTORS.
 - GALVANIZED HARDWARE FOR MOUNTING
 - FACTORY SHIMMED (FULL CONTACT SS) TO ELIMINATE SOFTFOOT.
 - PUSH BLOCKS SUPPLIED FOR POSITIONING
 - GROUND LUG
 - FACTORY LASER ALIGNED
- PREFERRED VSD: YASKAWA LV NEMA 1/3R (6 PULSE STD, 12/18/24 AVAILABLE AS OPTIONS)
 - CONSIDER FILTERS AS NEEDED: ISOLATION, INPUT/OUTPUT/PHASE SHIFTING
 - MATCH TO MOTOR HP AND KVA CALCS.
 - CAN SUPPLY MV (2300/4160) AS NEEDED
 - CAN SUPPLY S/U, S/D TRANSFORMERS AS DICTATED BY CLIENT NEEDS OR POWER UTILITY AVAILABLE AT LOCATION (SW TRANSFORMER).
 - MAY REQUIRE SPECIAL SIZING IF USING GENSET POWER
 - CONTROL PANEL CAN EMULATE VSD HMI (NO LOCAL CONTROL)

MOTORS/VSD'S



INSTRUMENTATION INTEGRATION

- EXISTING INSTRUMENTS ON SKID INCLUDE:
 - TC: TEMP RTDT (MOORE INDUSTRIES) AND VIBE XMITTER (STI/METRIX)
 - MOTORS: RTD'S, SH (TERMINATED IN OWN JUNCTION BOXES ON MOTOR PROVIDED BY OEM)
 - OIL COOLER: LEVEL SWITCH, CONSIDERING ADDING PRESSURE SWITCH AND IMMERSION HEATER (FOR COLD WEATHER APPS-3 PHASE WATTAGE TBD)
 - ADD SEAL FLUSH INSTRUMENTS FOR ALT FLUID APPS (CRUDE: PLAN 65 LSH) (NGL: PLAN 52 PSH, LSL/LSH-24VDC)
- INVESTIGATING ADDING SUCTION AND DISCHARGE PRESSURE TRANSMITTERS (ROSEMOUNT OR ENDRESS HAUSER) CO-LOCATED AT FRONT OF SKID (CHEST HIGH) VIA BOLT ON STANDS WITH GAUGE VALVES. CONSIDERING ADDING PLATE BETWEEN STANDS TO ALLOW FOR JUNCTION BOX MOUNTING AND WIRING VIA CABLING OF ALL INSTRUMENTS. ALSO
- OFF SKID INTEGRATION OF INSTRUMENTATION CONTROL PROCESSING (FLOW METERS, TANK LEVELS, PERMISSIVE, RELAYS, AUTOMATED VALVES)
- JUNCTION BOX: NEMA 4/7/9 AND HAVE 2 TERMINAL STRIPS: 1 FOR SWITCHES, 1 FOR TRANSMITTERS, WITH SIDE AND BOTTOM PENETRATIONS (NO TOP PENETRATIONS) FOR CABLES/GLANDS/SEAL OFFS
- ADDING STAND TO MOUNT PUMP PANEL AND INTEGRATE WITH VSD AND ON SKID INSTRUMENTATION. ALSO SCADA/TELEMETRY COMMS

PUMP PANEL FEATURES/INTEGRATION

- HEMMEN PUMP SYSTEMS HAS DEVELOPED ITS OWN UNIQUE PLC BASED CONTROL PANEL FOR USE WITH CENTRIFUGAL PUMPS. WE CUSTOM BUILD EVERY PANEL MATCHED TO EACH APPLICATION IN OUR OWN UL CERTIFIED (ETL UL 508A) ASSEMBLY SHOP. EACH PANEL HAS CUSTOMIZED PLC CONTROL LADDER LOGIC. A USER INTERFACE SCREEN SHOWS OPERATORS REAL TIME PUMP CURVES AND WHERE THE PUMP IS ACTUAL OPERATING. OTHER SCREENS ALLOW FOR PERMISSIVE AND EMULATOR SCREEN FOR VSD REAL TIME STATUS, AS WELL AS MAINTENANCE, AND REAL TIME DATALOGGING OF FLOW, PRESSURE AND VIBRATION. PANELS CAN BE SKID MOUNTED OR REMOTE MOUNTED IN THE FIELD, PER USE PREFERENCE.
- ON SKID/OFF SKID INSTRUMENTATION (PRESSURE, FLOW, VIBRATION, TEMP) CAN BE INTEGRATED INTO THE PANEL.
- WEB BASED ACCESS ALLOWS SUPERVISORS REAL TIME MONITORING AND FUNCTIONALITY FOR DETERMINING PUMP OPERATIONAL STATUS AND TROUBLESHOOTING OR THE ABILITY TO CHANGE PUMP PARAMETERS AS NEEDED. EACH PUMP WILL HAVE ITS OWN DEDICATED CONTROL PANEL
- TELEMETRY AND SCADA INTEGRATION ARE AVAILABLE VIA SPECIFIED COMMUNICATION PROTOCOLS. TELEMETRY/SCADA SERVICES CAN BE PROVIDED BY CLIENT PREFERENCE OR VIA HEMMEN, AS APPLICABLE. HEMMEN USES IGNITION SOFTWARE SYSTEM
- FIELD SERVICE STARTUP, INTEGRATION AND DEBUGGING ARE ACCOMPLISHED USING HEMMEN'S TRAINED SERVICE TECHS AND SPECIALISTS
- ADDING STAND TO MOUNT PUMP PANEL AND INTEGRATE WITH VSD AND ON SKID INSTRUMENTATION. ALSO SCADA/TELEMETRY COMMS



PUMP PANEL FEATURES/INTEGRATI ON

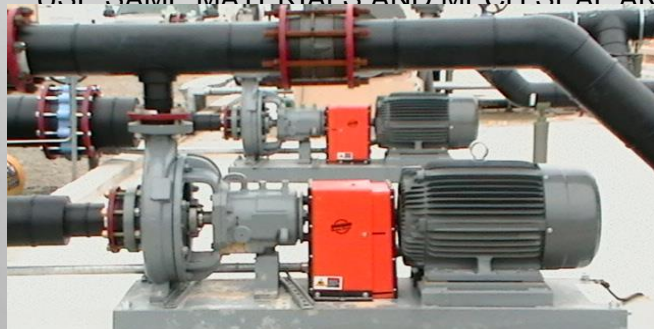


PUMP PANEL SHOP



CHARGE PUMP CONSIDERATIONS

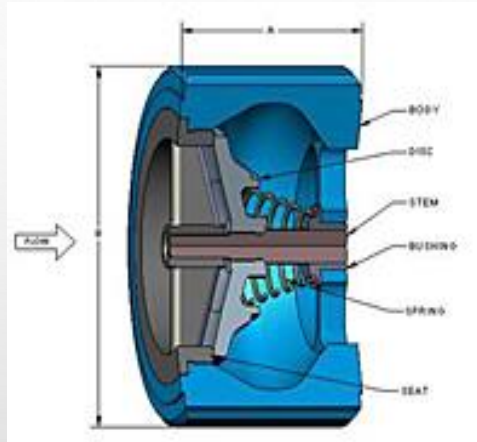
- OEM: COBRA/THK/MSK FOR SWD AND TRUCK UNLOADING TO TANKS. PENTAIR AURORA IS ANSI OFFERING
- CAN SUPPLY VSD OR STARTER FOR CHARGE PUMP
- AMINE APP TYPICALLY DO NOT REQUIRE
- NGL TYPICALLY REQUIRES VERT CAN AS SINGLE STAGE OVERHUNG ANSI/API CANNOT MANAGE SUCTION PRESSURE AND MEET NPSH
 - ALT CONSIDERATION: SIZE HPUMP FOR 30 HZ SPEED TO MEET NPSH WITHOUT NEED FOR CHARGE PUMP
- ROT:
 - DEDICATE 1 CHARGE PUMP TO EACH HPUMP
 - CHARGE PUMP FEEDING HPUMP SIZED FOR 4 POLE SPEED.
 - FLOW FOR CHARGE PUMP $\approx 1.2 \times$ HPUMP FLOW.
 - DISCHARGE PRESSURE 50-100 PSIG, FIXED 60 HZ SPEED.
 - USE SAME MATERIALS AND MECH SEAL AND FLUSH AS HPUMP



ADDITIONAL COMPONENTS/ACCESSORIES

- BAG FILTERS: PALL OR ROSEDALE
- CHECK VALVES: WLC-DFT
- BACKPRESSURE VALVE: CYCLONIC (MANUAL OR AUTOMATED)
- TRUCK UNLOADING PUMPS: THK/MSC WITH DRY RUN SEAL
- VERTICAL CANTILEVER/VORTEX SUMP: VERTIFLO
- KELLY HOSES
- TRANSFORMERS: S/U, S/D, ISOLATION, PHASE SHIFTING
- RENTAL UNITS: DOT TRAILER H PUMPS, RECIP PD PUMPS (CUATRO FIELD SERVICES)

ADDITIONAL COMPONENTS/ACCESSORIES



MANUFACTURING

- IF PARTS IN STOCK, CAN ASSEMBLE A UNIT IN 1WKS OR LESS
- SHOP ACCOMMODATES 3-4 UNIT ASSEMBLIES CONCURRENTLY, MAX
- STOCK ON FOLLOWING:
 - CHARGE PUMPS
 - VSD'S
 - STRUCTURAL SKIDS
 - HPS COMPONENTS (PUMP BARRELS, TC'S, SEALS, COUPLINGS, INTAKE/DISCHARGE, CLAMPS)
 - FILTER POTS
- OEM PAINT SYSTEMS USED FOR PUMPS. SKIDS GREY DARK MACHINE GREY.
- KANBAN FASTENERS/HARDWARE KEPT IN STOCK: (CLAMPS, MOTOR MOUNTING, PUMPS, TC/TOMBSTONE, COOLER MOUNTING, INSTRUMENT MOUNTING, SEAL FLUSH MOUNTING, INTAKE/ADAPTER/DISCHARGE)
- IMPLEMENTING REPAIR OF TC'S (ALL BRANDS EXCEPT DXP)
 - CLEAN DEDICATED SHOP AREA
 - TOOLS/JIGS/FIXTURES SOURCED
 - SOURCING BEARINGS AND OIL SEALS LOCALLY FOR REPAIRS (INVENTORY)
 - OUTSOURCE PAINTING
 - RECORD LOG FOR REPAIRS/SERIALIZATION
 - TC LUBRICANTS IN STOCK

SERVICE/TRAINING

Emergency Service

Repairs

Scheduled maintenance during plant shutdowns with quick turnaround

Installation / Start-Up / Commissioning

Site Auditing

Diagnostic Surveys & Troubleshooting

Job Specific Reporting

Vibration Analysis

Preventative Maintenance and Master Service Agreements/Contracts

Laser Alignment Repairs, Retrofitting, Rederssment

Inventory Analysis

Maintenance Training/Cutsomized Classroom and Product Training

Root Cause / Failure Analysis

Stock of Key Components

CONTACTS FOR AFTER HOURS AND FS SUPPORT

NEED SERVICE AFTER HOURS

HEMMEN ASSOCIATES IS WORKING HARD TO SERVE YOU 24 HOURS 7 DAYS A WEEK. CONTACT ONE OF OUR ASSOCIATES BELOW FOR FAST COURTEOUS SERVICE

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FAX : 903-234-8939

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PICS

