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REPORT

ON

PACKAGED PUMPING SYSTEMS

Grundfos Manufacturing Corp.
Fresno, California

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DESCRIPTION

GENERAL:

Section General of this Procedure file must be used as a supplement to this Descriptive Section. It contains information describing requirements for components and construction for products described in this section.

PRODUCT COVERED:

USL, CNL Packaged Pumping Systems, Hydro 2000 Series, Hydro MPC Series, BoosterpaQ, CMBE, CRE-Plus, CR-Plus, **GES**, Hydro Multi-B, Hydro Multi-E, Hydro Solo-E and Hydro Solo-S, Hydro NP.

RATINGS

Model/Type	Maximum Voltage (V)	Maximum Current (A)	Frequency (Hz)	Phase
Hydro 2000 Series	230	1200	60	1
Hydro 2000 Series	575	1200	60	3
Hydro MPC Series	230	1200	60	1
Hydro MPC Series	575	1200	60	3
Boosterpaq	230	1200	60	1
Boosterpaq	575	1200	60	3
CMBE	240	60	60	1
CMBE	575	60	60	3
CRE-Plus	230	200	60	1
CRE-Plus	575	200	60	3
CR-Plus	230	200	60	1
CR-Plus	575	200	60	3
GES	240	1200	60	1
GES	575	2000	60	3
Hydro Multi-B	230	100	60	1
Hydro Multi-B	575	200	60	3
Hydro Multi-E	230	100	60	1
Hydro Multi-E	460	200	60	3
Hydro Solo-E	230	200	60	1
Hydro Solo-E	575	200	60	3
Hydro Solo-S	230	100	60	1
Hydro Solo-S	575	200	60	3
Hydro NP	230	1200	60	1
Hydro NP	575	1200	60	3

ENGINEERING CONSIDERATIONS:

These are fluid handling systems that may consist of pumps, electric motors, adjustable frequency drives, controls, valves, gauges, and piping. The components may be mounted on a structural steel base. The control panel or Motor Control Center, if required, may be remotely mounted. Pumps, electric motors, frequency drives, control valves, gauges and piping must be used within rated working pressure and assigned electrical and environmental ratings.

These pumping systems are not intended for use with Classified materials (NFPA 497M) or for use in Classified (Hazardous) Locations as defined in Article 500 of the National Electrical Code.

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These pumping systems may be for use with HVAC equipment but may not contain components of the HVAC system unless specifically described. Pumping systems with HVAC components are to be investigated under Heating and Cooling Equipment (LZFE) or Specialty Refrigeration Equipment (SROT).

These pumping systems may not be used for fire service. Pumping systems for fire service are to be investigated under Fire Pump Motors (QXZF).

These pumping systems may not be for use with field-supplied hot tubs, spas, or swimming pools. These are to be covered under Hot Tub and Spa Equipment Assemblies (WBYQ), or Pumps (WCSX).

TECHNICAL CONSIDERATIONS (NOT FOR FIELD REPRESENTATIVE USE):

Products designated USL have been investigated using requirements contained in the following standards:

- *UL 508A - Industrial Control Panels.
- *UL 508 - Industrial Control Equipment.
- *UL 778 - Motor-Operated Water Pumps.

Products designated CNL have been investigated using requirements contained in the following Canadian standards:

- *CSA C22.2 No.14 - Industrial Control Equipment.
- *CSA C22.2 No. 108 - Liquid Pumps.

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MARKINGS:

These Package Pumping Systems are marked with the Listee's name, electrical ratings (electrical rating may be marked on the control panel), the date of manufacture, and model designation. The control panel includes markings as required by UL 508A, such as the overall system electrical rating and largest motor size. The Motor Control center is provided with appropriate markings per UL 845 such as the current, voltage, short circuit ratings, number of phases if other than single phase, as well as current elements tables and wiring diagrams for overload relays as applicable.

Correlation markings are provided to match the control panel or Motor Control Center to the appropriate frame assembly. The correlation markings may be on the equipment or on the system drawings/schematics.

Frame and the control panel may be labeled separately provided that the label has correlation information indicating that these devices are used together.

The **CRE-Plus, CR-Plus and CMBE** system's motor nameplate is marked with input voltage and current.

Required markings shall be of metal or a suitable R/C (PGDQ2) label system or may be a R/C (PGJI2) label material used with suitable printer and ink combinations as indicated in the listing card. Other markings shall be of any material and secured mechanically or by adhesive.

Within Canada, there are federal and local statutes and regulations, such as the Consumer Packaging and Labeling Act, requiring the use of bilingual product markings on products intended for the Canadian market. It is the responsibility of the manufacturer (or distributor) to comply with this law. The UL Follow-Up Service Procedures will only include the English versions of the markings.

ABBREVIATIONS:

The descriptions of certain components in this report contain the notation "R/C" or "CN". The notation "R/C" indicates that the component is UL Recognized. "CN" indicates that the component has been evaluated to Canadian requirements. Whenever "CN" appears in the component description, the Field Representative shall confirm that the component has a CSA Certification Mark, a Canadian UL Listing Mark, a Canadian UL Recognition Mark, or an equivalent identifier, if the product described in this report bears the C-UL Mark.

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CONSTRUCTION DETAILS:

Packaged pumping systems provided with the CNL marking shall use components that have been certified (CN) for use in Canada.

The scope of these construction details are not intended to cover the contents of the Listed Industrial Control Panel.

Products covered by this report shall comply with applicable component construction, rating, and marking requirements contained in UL508A, the Standard for Industrial Control Panels, and any additional information provided in this Procedure.

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The following types of component parts may be used interchangeably in any of the devices covered by this Report. Component parts within a Listed subassembly (such as a Listed control panel) need not be re-evaluated.

Pumps, electric motors, frequency drives, control valves, sensors, gauges and piping must be used within their rated working pressure, used with appropriate liquids, and used within appropriate ratings and conditions of use.

Any Listed device can be used per its intended use and installed according to instructions provided by the manufacturer including mounting means, electrical wiring connections and routing, ventilation, required spacing between components, and required protective devices; and not exceeding its marked electrical and environmental rating.

Components - All components shall be reliably secured and prevented from shifting or movement in place by other than friction between surfaces. Components shall be spaced such that electrical spacings as specified above are maintained.

All power circuit wiring is copper conductor and is R/C (AVLV2), AWM, temperature rating 90°C (UL 508A).

Schematic Diagram - A schematic diagram of the packaged pumping system shall be provided with each unit. Factory installed equipment and components shall be shown on the diagram. Also, the list of factory installed components shall be provided in each unit.

* Spacings - Spacings were evaluated in accordance with **Section General Table 1 (UL 508, Table 36.1 and UL 508A, Table 10.1.**

Enclosure Requirements - The intended environment for the System shall be as indicated by the environmental type rating of the control panel. Any electrical devices outside of the panel shall be marked as suitable for an equal or more severe environment.

Motor protection - Provided in the panel or in the Motor Control center for each motor, based on the nameplate rating of the motor involved and in accordance with UL 508A, the Standard for Industrial Control Panels or in

accordance with the Standard For Motor Control Centers, UL 845. If for outdoor use, the motors shall be of the enclosed type (TEFC) or have a suitable environmental rating.

* Model BoosterpaQ (Hydro MPC and Hydro 2000 **Series**), Hydro Multi-B **and GES** may have the motor protection provided as part of the motor/driver combination. Refer to product descriptions, Item 1, 2, or 3 Pump/Motor and as noted below.

Model CMBE, CRE-Plus and Hydro Multi-E motor protection is provided as part of the motor/driver combination. Refer to product descriptions, Item 1 or 2, Pump/Motor and as noted below.

Model Hydro Solo-E may have the motor protection provided as part of the motor/driver combination. Refer to product description, Item 1, 2 or 3, Pump/Motor as noted below.

1. Grundfos Type MLE motors, 1 phase, provide motor protection in the built-in motor controller. Motor protection is not required to be in the control panel (NMMS.E169171) for these motors or (XDNW2/8, E359133) motors .
2. Grundfos Type MLE motors, 3 phase, provide motor protection in the built-in motor controller. Motor protection is not required to be in the control panel (NMMS.E169171) for these motors or (XDNW2/8, E359133) motors. Motor protection is required to be in the control panel for MLE motors in UL File E164666.
3. Motor protection is provided in UL Listed Frequency Drives. Motor protection is not required in panels for motors that are controlled by UL Listed Frequency Drives that are marked as having motor overload protection.

UL Listed Power Conversion Equipment, (NMMS), provided with motor overload protection maybe used in the control panel.

Model Hydro NP **and GES - Design = X** are supplied without Industrial Control Panel. When not provided with an Industrial Control Panel, the end user will supply Industrial Control Panel.

Spacings - Spacings between uninsulated live parts of different circuits or of opposite polarity shall be as follows:

MINIMUM SPACINGS, inches (mm)

0-50V		51-150V		151-300V		301-600V	
<u>through</u> <u>air</u>	<u>over</u> <u>surface</u>	<u>through</u> <u>air</u>	<u>over</u> <u>surface</u>	<u>through</u> <u>air</u>	<u>over</u> <u>surface</u>	<u>through</u> <u>air</u>	<u>over</u> <u>surface</u>
1/16 (1.6)	1/16 (1.6)	1/8 (3.2)	1/4 (6.4)	1/4 (6.4)	3/8 (9.6)	3/8 (9.6)	1/2 (12.7)

Minimum spacings between uninsulated live parts and grounded parts shall be 1/2 in. (12.7 mm). Minimum spacings at field wiring terminals shall be 1/4 in. (6.4 mm), except may be 1/8 in. (3.2 mm) through air at 50 V or less.

Wire Routing - Wiring is bundled, routed in insulated wireways, or otherwise routed away from moving parts, rough surfaces, or sharp edges. Routing channels, wireways and guides within the enclosure need not be Listed or Recognized Component. All secondary circuit wiring shall be reliably and positively routed away from all insulated or uninsulated live parts of different circuits unless the secondary circuit wiring also has insulation that would be suitable for primary circuit use. Separation of insulated conductors may be accomplished by clamping, routing, or equivalent means which insures permanent separation from insulated or uninsulated live parts of a different circuit.

Wire Terminations - Listed terminals or crimped closed-loop eyelet terminals, or at pressure connectors of component devices. Solid wire may be formed in loops at least three-quarters around terminal screws, or in mechanically secured and soldered connections. Stranded wiring terminated at wire binding screws is soldered or the terminals have upturned edges, cupped washers, or equivalent, to retain the stranding so that no strands protrude from the terminal connector. Multiple conductors can be secured to a single termination point where a reliable electrical and mechanical connection is made without loose, unretained, or severed stranding.

If provided, open type eyelets have upturned edges or crimp around the screw shank, or all wiring is done in harnesses and/or formed so that loosening of the terminal screw will not result in the conductor coming away from the intended connection.

Quick connect terminals can be used for factory (but not field) connections if mated as intended with terminals integrally provided on components included in this Report, and they have a dimple, depression, or spring type connection such that a snap action connection is accomplished.

Model Differences - The packaged pumping system, Model Hydro 2000 Series and Hydro MPC Series were considered the basic model and representative of Models BoosterpaQ, CMBE, CRE-Plus, CR-Plus, **GES**, Hydro Multi-B, Hydro Multi-E Systems, Hydro Solo-E, Hydro Solo-S and Hydro NP systems.

Hydro Multi-B

HYDRO MULTI-B SYSTEM	HYDRO MULTI-B	E	2	CME10-20	10Hp	1PH	230 V	60 HZ
TYPE	X							
FAMILY E-ES		X						
NUMBER OF FULL SIZE PUMPS 2 - 4			X					
FULL SIZE PUMP FAMILY				X				
HORSEPOWER 0.5-10					X			
PHASE 1 or 3						X		
POWER SUPPLY VOLTAGE, 115, 208, 230, 400, 460 OR 575							X	
FREQUENCY 50 or 60Hz								X
Additional Suffixes								

GES SYSTEM (Grundfos Engineered System)

	GES	E	3	PA	SC	U1	B	10	A	1	CWT	ABCD
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
I: Grundfos Engineered System - GES	X											
II: Control System Type: E - All Pumps E or CUE, F - Fixed Speed Pumps, 1 CUE, S - Fixes Speed Pumps, Z - Custom		X										
III: Number of Pumps:			X									
IV: Pump Make: GR - Grundfos, PA - Paco, PE - Peerless, YE - Yeomans, XX - Other				X								
V: Pump Type: CR - VMS, ES- End Suction, SC - Split Case, TU - Turbine, WW - Waste Water					X							
VI: Voltage Code: U1 - 3 x 208-230 V, 60 Hz; U2 - 3 x 460 V, 60 Hz; U3 - 3 x 575 V, 60 Hz; U4 - 1 x 208-230 V, 60 Hz						X						
VII: Design: A - Systems with control Cabinet mounted on same base frame as the pumps; B - Systems with control cabinet centered on the base frame; C - Systems with control cabinet mounted on its own base for floor mounting; D - Systems with control cabinet mounted on its own base frame;							X					

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COMPONENT PARTS:

The following types of component parts may be used interchangeably in any of the devices covered by this Report. Component parts within a listed subassembly (such as a Listed control panel) need not be re-evaluated.

Any Listed device can be used for its intended use not exceeding its marked rating.

R/C Factory Automation Equipment (GPNY2) or Industrial Control Equipment (NIMX2 and subcategories) that are not restricted to nonindustrial use (such as appliances, business machines, air conditioning and refrigeration equipment, etc.) can be used within their marked load ratings.

Exception: Recognized Component solid state devices such as solid state relays, motor speed controllers, power conversion equipment, and others can be used only when specified elsewhere in this Report.

All heat exchangers, expansion tanks, and pressure tanks are certified and labeled as complying with ASME Section 8. As an alternative, tanks operating below 300 psi may be pressure tested or provided with vendor documentation verifying the marked pressure rating of the tank.

Limited Voltage/Current Source - Consists of a UL Listed or R/C general purpose transformer with a single secondary winding rated 30 V or less, or a (QQAQ2) power supply, (A Class 2 or isolated secondary circuit), with a secondary fuse of maximum 5.0 A for 15 V maximum circuits, or maximum 3.2 A for 15.1 - 30 V circuits. Devices supplied solely by a Limited Voltage/Current Source can have direct connection to any device external outside of the Industrial Control Panel, Item 1, and need not be further evaluated.

BoosterpaQ (Hydro MPC Series and Hydro 2000 Series) **and GES** - Grundfos, Models PMU, PFU, CU 323, CU 351, CU 352, I/O 351A and I/O 351B controllers provides a Limited Voltage/Current source for external sensors.

CMBE and **CRE-Plus, GES (1 Pump Systems)** - Grundfos, MLE Motor/Driver Combination provides a Limited Voltage/Current source for external sensors.

Series CMBE do not contain a power disconnect switch. The field wiring is accomplished in the motor terminal field wiring compartment.

Hydro Multi-E and Hydro Multi-B - Grundfos, MLE Motor/Driver Combination provides a Limited Voltage/Current source for external sensors. Grundfos CU323 controllers provide a Limited Voltage/Current source for external sensors.

Hydro Solo-E - Grundfos, MLE Motor/Driver combination, UL Listed frequency drive provides a limited voltage/current source for external sensors.

Transient Protection - Any (FOWX2) or (XUHT2) used within its voltage rating and securely mounted. Electrical spacings are maintained between uninsulated parts of the component to parts of opposite polarity, other circuits, dead-metal or grounded metal parts. The body of the component is to be considered live unless additionally insulated.

Printed Wiring Materials - Any (ZPMV2) rated minimum 105°C.

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Terminal Blocks - Listed pressure connectors may be used within their marked wire range and secured to a phenolic body with movement prevented and with spacings provided. Alternately, wire binding screw type may be used where two full threads are engaged in phenolic, one wire per terminal, under the following conditions:

Field wire size	14 AWG	8 - 14 AWG
Screw size	6	8
Terminal plate	0.030 in. minimum plated copper alloy	0.050 in. minimum plated copper alloy

Terminal Blocks - Any (XCFR2) suitable for industrial use, used within their marked electrical ratings (as indicated in the UL R/C Directory) and mounted with suitable electrical spacings being maintained.

Internal Wiring - Except where specifically described elsewhere in this Report, all internal wiring is copper and is rated minimum 90°C, (AVLV2) AWM with 1/32 in. thick or Listed MTW or general use wire, sized as follows:

<u>Conductor Size</u> <u>AWG or MCM (mm)</u>	<u>Maximum</u> <u>Ampacity</u>
22 (0.32)	3
20 (0.52)	5
18 (0.82)	7
16 (1.3)	10
14 (2.1)	20
12 (3.3)	25
10 (5.3)	40
8 (8.4)	60
6 (13.3)	80
4 (21.2)	105
3 (26.7)	120
2 (33.6)	140
1 (42.4)	165
0 (53.5)	195
00 (67.4)	225

PACKAGED PUMPING SYSTEMS

General - See ILLS. 2, 3, and 4 for examples of typical Hydro 2000, Hydro MPC, BoosterpaQ, or Hydro Multi-E systems. See ILLS. 5 and 6 for examples of typical CRE-Plus systems. See ILLS 5, 6, 7 and 8 for examples of typical Hydro Solo-E systems. See ILLS 9, 10, 11 and 12 for examples of typical Hydro Solo-S systems. See Ills 13 and 14 for example of Hydro Multi-B system. See Ills. 15 and 16 for example of CMBE System. **See Ills. 17-19 for example of various GES Systems.**

1. Enclosed Industrial Control Panel - (Optional) Listed (NITW) or Listed Motor Control Center (NJAV) and CN. Engineering Note: Customer provided Industrial Control Panels for Hydro NP **and GES - Design = X** systems only.
2. Pump/Motor - Any Listed or (PRGY2) and CN. The motors are to be mounted on the frame. If open type or drip proof, a water deflector is provided over all pump-to-motor shafts as needed to prevent water from entering the motor. Not applicable to vertically stacked pump-motor assemblies.
 - 2.1 Alternate - Same as above, except frame is optional for 1 pump system.
 - 2.2 Alternate - Same as above except, uses combination of PRGY2, Motors, Grundfos A/S, Cat. No.' ML71 through ML80 or ML90 through 132, and, NMMS2, Power Conversion Equipment, Grundfos Holding A/S, MLE followed by 90 through 132 followed by 2 letters, followed by suffixes (E169171, 6/24/2005). Motor protection is not required to be in the control panel for these motors. Frame is optional.
 - 2.3 Alternate - Same as above except, uses combination of PRGY2, Motors, Grundfos A/S, Cat. No. ML71 through ML80, and R/C (NMMS2), Power Conversion Equipment, Grundfos Holding A/S (E169171), model MLE followed by 71 or 80 followed by two letters followed by any alphanumeric suffixes. These devices are only to be mounted and used with one of the applicant motors, consisting of motor model ML71 and ML80, suffixes as noted below.

Models	Input voltage Vac	Input current A	Output voltage Vac	Output HP	Controls motor types	Frequency range Hz
MLE71	208-230	4.3	0-255	0.75	ML71AB-2 ML71BA-2	5-100
MLE80	208-230	7.50	0-255	1.50	ML80AA-2 ML80BA-2	5-100
MLE71	208-230	2,80	0-255	0.50	ML71AB-4 ML71BA-4	5-100
MLE80	208-230	5,40	0-255	1.00	ML80AA-4 ML80BA-4	5-100

These motor drives have a Type 1 environmental rating and are only intended for indoor use. The motor drives that have a Type 3R rating are suitable for outdoor use. The terminals are suitable for factory and field wiring. These drives incorporate motor overload protection and internal solid-state short circuit protection.

- 2.4 Alternate Motor Drive (USL Models Only) - Listed (NMMS), Grundfos Holding A/S, Part Nos. MLE160, MGE160, MLE180 and MGE180, input rated 380-480 V, 42.1 A maximum, output rated 0-400 V ac, 30 hp maximum, 1-120 Hz. Controls Motor types MGE/MLE-160-AA-2, -AB-2, -AC-2, -AA-4, -AC-4, MGE/MLE-180-AA-2, -AA-4. Additional drive outputs control light loads, indicator lights or alarms.
- 2.5 Alternate Motors - R/C (PRGY2/8), Grundfos Holding A/S, Part No. MLE160, MGE160, MLE180 and MGE180, rated input 380-480 V ac, 42.1 A maximum; output rated 30 hp maximum, Type 3R. Motor overheating protection provided by Listed Industrial Control Panel (Item 1).
- *2.6 Alternate Motors Electronically Protected - R/C (XDNW2/8.E359133), Grundfos, Part No. MLE, MGE or CME, rated

Voltage AC	Hz	Phase	Max. HP	Max. kW
115V	50/60	1	1	0.75
200 - 240 V	50/60	1	2	1.5
380 - 500 V	50/60	3	3	2.2
440 - 480 V	50/60	3	3	2.2
200 - 240 V	50/60	3	10	7.5
380 - 500	50/60	3	15	11
440 - 500	50/60	3	15	11
440 - 480	50/60	3	15	11

Engineering Note: Drive outputs control light loads, indicator light or alarms. Motors are rated Type 3 and 4.

3. Wiring - Listed wire, conduit, conduit fittings, and junction boxes. Current ampacity and insulation voltage sufficient for the circuit.

4. Low Voltage Components - Pressure transducers, flow sensors, solenoid valves or equivalent components. Listed, Recognized, or supplied by a Limited Voltage/Current Source within the industrial control panel as indicated in the construction details section of this Report.
5. Fluid Components - Provided with piping, headers, valves, and pumps to complete the fluid handling system. Piping, headers and valves are optional for these systems.
6. Hydro-Pneumatic Tanks - (Optional) Suitable for the pressure involved. See Construction Details.
7. Marking - Provided with instructions for priming the systems and to warn against operating without fluid.
8. Float - And Pressure - Operated Devices - (Optional) Any Listed or R/C (NKPZ2). See Construction Details for enclosure requirements.
9. Electrically Operated Valves - (Optional) Any Listed or (YIOZ2). See Construction Details for enclosure requirements.