MANUFACTURING EQUIPMENT
PURCHASE SPECIFICATION

NEXTEER

TITLE: Cooling/Quench Water System for Induction Equipment **NUMBER:** SD-1006

ISSUED BY: Mark Andrus **DATE:** 11/16/95 **APPROVED BY:**_ _9/18/17

REVISION: E **DATE:** 09/15/17 **SHEET:** 1 of 10

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DESCRIPTION **PAGE NO.**

I. SCOPE

A. The intent of this specification is to outline the basis for standardization in the design and build of a cooling-water system for induction power supplies and quench water systems for induction machines. This will facilitate common maintenance, re-tooling, and provide trouble-free production operation that will assure the quality and reliability of Nexteer Automotive products. It is not intended to inhibit design or progress of new technology in the "induction or machine tool" industry.

II. COOLING WATER

A. For the purpose of cooling, Nexteer Automotive will provide plant water through a "closed-loop" system. (U.S. only)

1. Maximum guaranteed differential water pressure is 30 p.s.i.
2. Maximum pressure is 100 p.s.i.
3. Maximum temperature of 90°F. (32°C.).
4. Maximum hardness of 80 PPM.
5. pH range of 6 to 9.
6. Conductivity of 1,000 ohms/cubic cm minimum.
7. See Appendix A and Appendix B of this specification for the required tower-water piping system that the vendor shall supply on the distilled-water system.

B. Cooling Water System

1. The quality of the water in the Nexteer Automotive plant water system is not sufficient for operation of an induction power supply. Therefore, the vendor shall furnish a distilled or de-ionized water system which shall be closed0loop and contain all components, including pump, motor, stainless-steel tank, valves, gauges, heat-exchanger, and all other required components per schematic included in this specification (see Sheet 6).
2. All components in contact with the cooling water shall be non-ferrous material (stainless steel, bronze, copper).

3. All piping components shall have permanently-mounted labels mounted near the component, and the numbers shall correspond to the cooling-water schematic diagram. All labels shall be laminated plastic (white top, black middle, white bottom layers) and shall be secured with drive screws. All hoses shall be tagged on both ends and number coded to the hose barbs to which they attach.
4. Pressure gauges shall be glycerin-filled type.
5. The heat exchanger shall be a plate and frame type, and must be accessible to repair, clean and able to add or subtract plates (Tranter, Alpha Laval).
6. Distilled water pump shall be mounted on rubber isolation mountings. The pump inlet and outlet piping shall contain stainless flex couplings. These features will help reduce pump noise and vibration.

C. On a distilled-water, or de-ionized water system the reservoir tank shall be supplied with the following features:

1. A hinged cover with a gasket.
2. A fill spout with 60-mesh screen. NOTE: On systems that are closed and pressurized (no atmosphere-vented reservoir).
3. Label on tank cover in 3-inch letters to read: "FILL WITH DISTILLED WATER ONLY".
4. Stainless-steel construction.
5. Water-level sight gauge.
6. Tank level indicator with low level faults in control logic.
7. Manual drain valve and plug.

D. The following information shall be specified during the design stage.

1. Minimum GPM of Nexteer Automotive's tower water (for water-to-water heat-exchanger) required when inverter is operating at full-rated power and 100% duty cycle.
2. Minimum GPM of distilled water at same conditions.
3. Quantity of distilled water in total system (gallons).
4. Piping size of connection to Nexteer Automotive's plant (tower) water system, and piping size of distilled-water output and return.

5. Motor horsepower, pump pressure, and pump flow rating.
6. The vendor shall furnish additional capacity in the distilled-water system to cool transformer and bus in the heat station and the output bus and induction coils.

E. All shut-off valves on distilled-water system shall be mounted on the outside of cabinets.

F. The water system must be supplied with a 3-phase combination motor-starter accessed through operator interface in auto and manual modes.

G. The complete system shall be mounted on a rigid structural-steel common base.

H. All flow meters (deionized water and quench systems) must operate by measuring differential pressure across an orifice.

III. INTEGRAL QUENCH SYSTEM

A. See Appendix B of this specification for the schematic and parts lists of an integral quench system. This schematic and parts list is only intended as a baseline drawing for quench system design. Not all necessary instrumentation and electronics are shown. The schematic in Appendix B is only a suggested quench system design. Other system designs are acceptable pending Nexteer Automotive process engineer approval. Bypassing high flow rates of quench though the heat exchanger can cause high levels of noise. Therefore, separate bypass lines or a separate circuit and pump may be included in the design.

B. Quench Reservoir Construction

1. There shall be a 2" diameter drain valve. The base of the tank shall have a 1/8" foot slope to insure proper drainage.
2. The reservoir shall be fabricated of ¼" stainless steel, double welded at all seams.
3. The minimum volume of each tank shall be two times the per-minute capacity of the quench supply pump.
4. The quench reservoir shall be equipped with an electric heater located in an area of the tank where a natural swirling action of the quench water will prevent a dead zone of heated water. The thermocouple of the temperature controller shall be located in such a manner to prevent cycling

effects caused by the heater. The reservoir shall also contain a drain with ball valve.

5. There shall be easy access to the quench tank to safely check the quench concentration while the machine is running.

C. An appropriately sized quench pump and plate and frame heat exchanger shall be used to control the quench temperature. The system must be capable of maintaining the quench temperature at 95°F, ± 5°F. There shall be an immersed heater in the tank to keep the quench temperature above 90°. Quench shall be heated to operating temperature within 10 minutes of start-up.

D. The entire quench system and machine shall be designed to be compatible with Ucon Quenchant A and Houghton Aquaquench 251.

E. The quench system shall consist of two parallel circuits. All of the quench will be pumped out of the quench tank and pass through the quench filter. There shall be two quench filters (400 micron bag filters) in parallel configuration. There shall be a manual valve placed after the pump and before the filters used to select which filter the quench will pass through. There shall be a differential pressure switch connected to the machine controls notifying the operator of a dirty filter. After the filters, the quench system splits into the two parallel circuits; the process circuit and the cooling circuit. The cooling circuit consists of the plate and frame heat exchanger where heat is extracted from the quench by the plant tower water. The heat exchanger quench side outlet drains directly back into the quench tank. The quench process circuit consists of the appropriate instrumentation to monitor quench parameters such as temperature, pressure, and flow, as well as the main quench valve(s) and nozzles(s). There shall be an automatic, air operated, quench valve, as well as a flow meter, for each quench line. The system shall be designed such that when the quench valves are completely opened (maximum flow through the process circuit), the quench flow through the heat exchanger is equal to or greater than 30% of the total quench flow. The responsible Nexteer Automotive Process Engineer must approve the filtration and quench system being proposed.

F. The quench flow available to the quench rings shall be 150 g.p.m. @ 35 p.s.i. minimum.

G. The heat exchanger shall be a plate and frame type, and must be accessible to repair, clean, and able to add or subtract plates.

H. Quench pump and motor shall be mounted on rubber isolation mountings. The inlet and outlet quench piping shall contain flex pipe couplings.

I. The quench delivery system shall be designed to eliminate quench flow and pressure variations when multiple quench rings are being supplied at the same time.

J. The quench system flow capacity shall be increased by 20% above design calculations. The quench manifolds shall be throttled by a minimum of 20% with globe valves so there is more quench available if necessary.

K. The two quench supply manifolds shall contain glycerin filled pressure gages.

L. The quench flow for both quench supply manifolds must be monitored by a flow switch/meter. Type and brand to be determined and approved by the Process Engineer in charge.

M. The quench delivery system shall have globe style valves for adjusting flow control, full flow ball valves for manual on/off control, and have fast acting pneumatically actuated ball style valves (brass or stainless) for automatic on/off control.

N. There shall be a programmable timer to start the quench heater before the start of the shift.

O. Every effort should be made to eliminate quench from dripping off the quench ring onto the operator's hands. This will include proper quench hose routing and possible using full flow check valves so as not to restrict the quench flow.

P. All quench rings shall be designed to be disassembled for maintenance.

Q. A schematic of the quench system must be submitted to the responsible Process Engineer for approval prior to construction.

R. The accuracy of all electronic temperature sensors must be verified with a calibrated thermometer. The sensors must be within one half of a degree (Celsius) of the calibrated value.

S. There shall be a quench purging function which will purge all the quench fluid from the lines if the machine sits idle for more than 10 minutes. When the machine sits idle, a PLC timer shall start. When the timer reaches 10 minutes, the machine shall lose the “Ready for Cycle” bit and require the “Machine Home”, or “Auto Initiate” function. When the machine is homed, or initiated, the quench valve shall open for 30 seconds to purge the cool quench and air bubbles from the quench lines. **The**

logic must be written to ensure that the normal heat cycle does not initiate before this quench purge is done. No overlap of purge cycle and normal machine cycle is allowed.

IV. NAMEPLATE

The water system shall have permanently-attached nameplate with the following engraved (or stamped) information:

A. Manufacturer's name, address, and phone number.

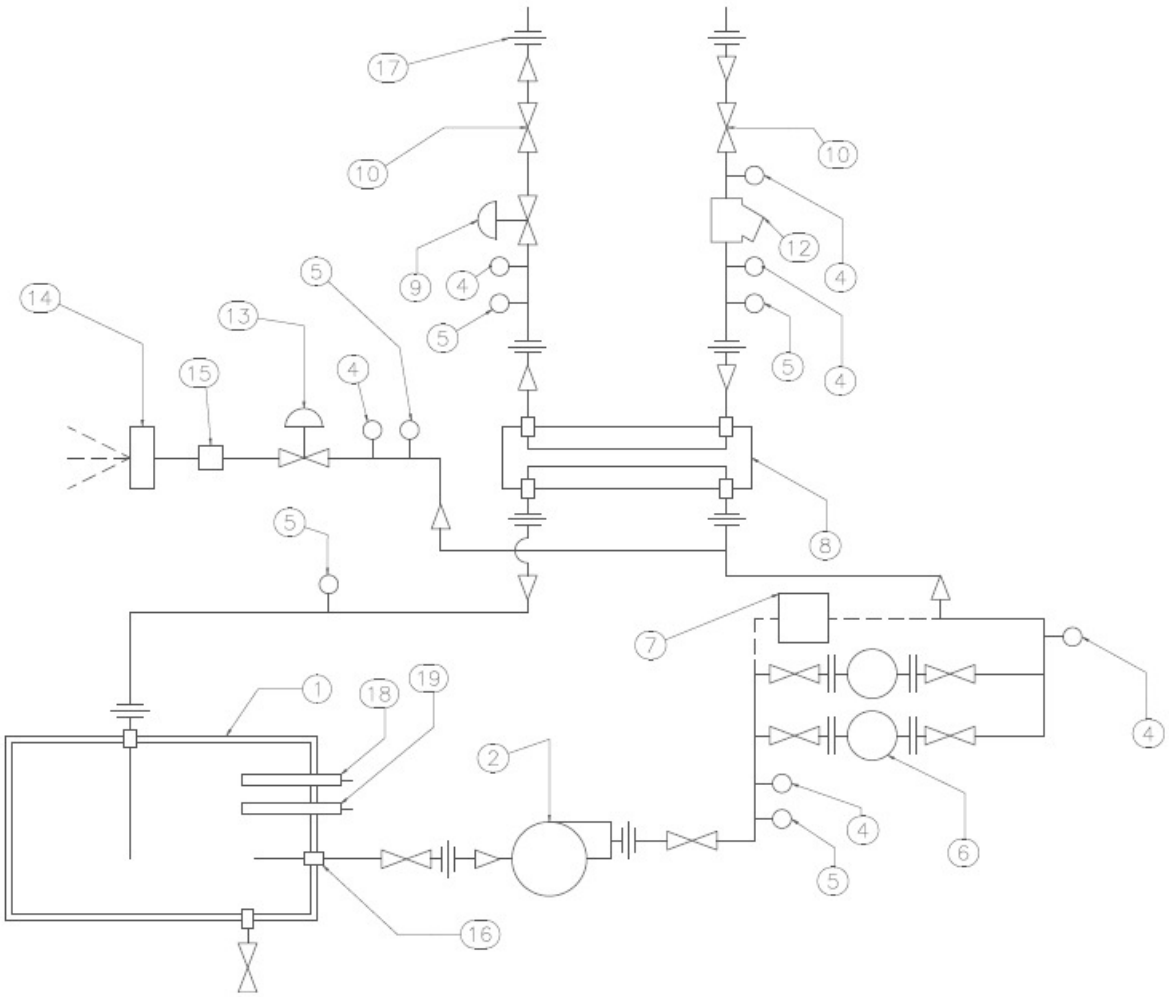
B. Serial number and model number.

C. Maximum heat-removal capability.

V. APPENDIX A

Please see file "SS-SD-SAMPLE-COL-2007-03-07.zip "for circuit diagrams and parts list.

VI. APPENDIX B



ITEM	# REQ'D	DESCRIPTION
1	1	QUENCH TANK
2	1	APPROPRIATELY SIZED QUENCH PUMP
4	6	GLYCERIN FILLED PRESSURE GAUGE
5	5	TEMPERATURE GAUGE
6	2	400 MICRON BAG FILTER (TWO IN PARALLEL)
7	1	DIFFERENTIAL PRESSURE SWITCH
8	1	HEAT EXCHANGER - PLATE & FRAME
9	1	AIR ACTIVATED VALVE FOR COOLING WATER CONTROL (WITH FLOW CONTROLS FOR SLOW ACTUATION)
10	8	MANUAL BALL VALVE
12	1	Y TYPE STRAINER, BRONZE
13	---	AIR ACTIVATED QUENCH VALVE (ONE FOR EACH QUENCH LINE REQUIRED)
14	---	QUENCH NOZZLES
15	---	QUENCH LINE FLOW METER (ONE FOR EACH QUENCH LINE REQUIRED) – KOBOLD OR ELETTA
16	1	SCREEN TO FILTER QUENCH PUMP INLET
17	9	PIPE UNION
18	1	TEMPERATURE SENSOR

19	1	SUMBERSED ELECTRIC HEATER

VII. SPECIFICATION REVISION SHEET

Page	Symbol	Revision	Date	Issued By
All	A	Complete Rewrite	04 Apr 1998	Ron Hoppe
5	B	Appendix A Det. No. 3609 changed valve description was a Sarco valve.	18 Aug 2002	Ron Hoppe
All	C	Complete Rewrite	11Jan08	Mark Andrus
All	D	Touch up	28 SEP 2012	David Novak
6&7	E	Add verbiage for quench purge function, add logic review for no heating during purge.	15Sep2017	Keith Daenzer