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1 Purpose

This specification defines the location specific requirements for subcontracted, custom test equipment.

This specification applies to the Farmington Hills, Plymouth, and South Bend locations.

2 Definitions

GDS	Bosch General Delivery Specifications for Machinery and Equipment
Fh	Farmington Hills, MI location
Ply	Plymouth, MI location
Sbd	South Bend, IN location

3 References

MIOSHA	Michigan Occupational Safety and Health Administration
IOSHA	Indiana Occupational Safety and Health Administration
MSDS	Material Safety Data Sheet
GDS	Bosch General Delivery Specifications for Machinery and Equipment
LoTo	Lock-Out Tag-Out Identification Standard

4 Procedure

4.1 General

4.1.1 Building Services Available

- Electrical
 - 480 Volt, 3 phase, 60 cycle $\pm 15\%$
 - 208 Volt, 1 phase, 60 cycle $\pm 15\%$
 - 120 Volt, 1 phase, 60 cycle $\pm 15\%$
- Compressed Air
 - 100 psi
- Water
 - City water 75 psi
 - Fh process water supply 48 psi, return 18 psi (nominal 30 psi delta)
 - Ply process water supply 60 psi, return 20 psi (nominal 40 psi delta)
- Natural Gas
 - Natural Gas provided at 10 psi per cubic foot
- Vacuum
 - 1,640 ACFM @ 25"Hg (Fh only)

4.1.2 Health, Safety, and Environmental (GDS 3.2.1 and 3.2.6)

- Every machine shall conform to all applicable local, state and federal safety standards per the primary references listed in Appendix "A".
- A Lockout/Tagout diagram must be posted on every machine describing the method to diffuse and lockout any sources of energy

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in the machine for safe maintenance. The program standard is attached. Note- site review and approval is required prior to final installation.

Arc Flash considerations shall be reviewed with facilities and appropriate measures shall be planned for at the time of quotation. Wherever possible, segregate low voltage signaling from voltages over 50V to provide easier handling for calibration or technician access.

4.2 Mechanical Design

4.2.1 Drawing Format (GDS 5.1.2.4 e)

- Drawing format shall be compatible with *.DWG drawings.

4.2.2 Components (GDS 5.1.1.2, 5.2.3.2.1, 5.2.3.3.4)

- Refer to Appendix “B” for a list of component requirements.
- SAE hardware is used throughout the test stand unless otherwise noted.
- Test stand enclosures are standard frame with Stainless Steel panels.
- Water filter housings shall be compatible with AquaPure part # AP110 filter elements.
- Fuel/Viscor filter housings shall be compatible with Hytrex Filter GX05-10 filter elements.
- Heat exchangers shall be Galvanized or Stainless Steel construction (no copper).
- Heat exchanger outlets will have provisions to shut off water flow when the equipment is not operating.
- All parts selected by supplier are to be reviewed/approved by Bosch Project Engineer prior to final design.
- A single disconnect will be utilized where possible for each energy source (pneumatic, electric, hydraulic) to facilitate LoTo requirements.

4.2.3 Equipment Color (GDS 5.1.6.4)

- Bosch Blue 75 (75C, 35M, 0Y,40K)
- Bosch Silver (Pantone 877 RAL 9006 White Aluminum)
- Bosch Red (0C, 100M, 100Y, 0K)
- Stainless (where corrosive elements may not tolerate paint)

4.3 Electrical Design

4.3.1 Drawing Format (GDS 5.2.1.2)

- Drawing format shall be compatible with *.DWG drawings.

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4.3.2 Wire Color (GDS 5.2.4.7.1)

- Black: Ungrounded control, load and line conductors at line voltage.
- Red: Ungrounded AC control conductors below line voltage.
- Blue: Ungrounded DC control conductors.
- White: Grounded AC conductors.
- White w/Blue: DC return conductors.
- Green: Chassis Ground.
- Note: Line voltage should be considered to be 200 VAC and above.

4.3.3 Wire Termination

- All panels shall be equipped with terminal blocks or attachment plugs for all outgoing control conductors (unless signal loss or noise may be of concern).
- Splicing is prohibited

4.3.4 Wiring for Low Electrical Noise

- The mechanical layout of test stands and panels within must include electrical noise considerations. Control and high current circuitry shall be physically separated and shielded as much as possible from transducers and signal conditioners.
- Position signal conditioners and shunt cal relays as close as possible to transducers.
- Position high current drivers such as solenoid and motor drives in a shielded compartment as near the load as possible. (24 Vdc solenoids are preferred when possible – less noise)
- Bring control and data acquisition wiring to computer from different directions to reduce coupling. Wires placed at 90 degree angles will magnetically couple the least.
- Always route and bundle noisy driver and digital control signals separately from low-level analog signals.
- Reduce loop area of signals and their respective return lines by twisting or running closely parallel.
- Route wires close to grounded metal surfaces rather than out in space.
- All sub-assemblies must be well grounded to the test stand chassis. Assemblies attached only with painted rack mount ears must be grounded with a strap.
- Ground power supply commons at a single point on the chassis near the power supply unless otherwise specified.
- Do not use switching power supplies unless specifically requested.
- All transducers shall be connected to a signal conditioner using twisted pairs in a shielded cable. A pair for excitation, a pair for output, and a third pair for shunt cal if required. All transducer cable shields shall be grounded only at one end.

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- Closely follow all recommendations for motor drive wiring. Be sure to include all filters. Ground shield of high-current drive output cables at both ends.

4.3.5 Custom Circuits

- All schematics of custom circuits used in the test stand shall be supplied to Bosch including all Gerber plots.

4.3.6 UPS

- All test systems shall incorporate monitored UPS capability to shutdown the equipment in a controlled fashion in the event of a power loss.

4.3.7 Wire insulation

- If equipment is to be operated in a corrosive environment wire with appropriate jacket material shall be used, for example, wire with Teflon insulation will be used if wires are exposed to brake fluid as part of normal operation

4.4 Software Design

4.4.1 Computers

- Computers supplied with any equipment must comply with the Bosch data security policy. Computer shall be supplied with virus protection. Computer host name / machine name shall be defined by Bosch. A local login shall be created for tester usage according to Bosch requirements. Automatic login to the equipment is not permitted, passwords must be used. The local administrator account shall not be used for normal tester operations.

4.4.2 Language

- The main program should be written with Microsoft Visual Basic.NET.
- Use of any other programming language must be approved by Bosch.
- All software developed for a Robert Bosch LLC Test System will be the property of Robert Bosch LLC and may be duplicated and re-used as Robert Bosch LLC deems appropriate.
- All software developed for a Robert Bosch LLC Test System will be provided with source code, relevant necessary libraries, and development tools.
- Libraries necessary for code execution must be available at no additional charge for duplication and re-use by Robert Bosch LLC.
- The software version should be encoded into the program code to be part of the test display. Also, record the description of the test

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system software revision in a text file maintained with the source code to maintain revision detail and history.

- Software will include manual control screen and display screen for calibration purposes.

4.4.3 Revision Control

- Revision format will be: X.Y.Z – X represents a large revision that begins at 1. Y and Z are set to 0. – Y represents a small revision that begins at 0 and is incremented Z is set to 0. – Z represents a developmental status of the software. Z begins at 0 and may be incremented whenever development software is being tested.

4.4.4 Preferred Communication Technology (GDS 5.2.2.6)

- Ethernet TCP/IP
- GPIB (IEEE 488.1)
- LXI (LAN eXtensions for Instrumentation)
- USB

4.4.5 Software Development

- Software shall be developed in accordance with Bosch Software Coding Guideline FG4.7.03.078

4.4.6 User Interface

- The main user interface requirements will be defined at time of request for quote. At a minimum the test system will have the ability to manually control all outputs and display all inputs for the purpose of calibration, functionality verification, and troubleshooting.

4.5 Floor Plan Layout

4.5.1 Drawing Format (GDS 4.2.2)

- Drawing format shall be compatible with *.DWG drawings.

4.6 Calibration

4.6.1 Access to components requiring calibration (GDS 5.1.1.3)

- Equipment shall be supplied with procedures for calibration. A detailed description of any specific devices required to conduct the equipment calibration will be included with the equipment.
- Calibration ports, isolation valves, and quick disconnect fittings will be included where practical to facilitate calibration of pressure transducers, flow meters, etc.

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- A sufficient excess length of wire (loop) will be provided for pressure transducers to be placed off stand on portable calibration cart during calibrations.

4.7 Programmable Logic Controllers and Computers

4.7.1 Programmable Logic Controllers (GDS 5.2.5.1)

- Preferred PLC manufactures are Bosch Rexroth and Siemens. Any alternate PLC manufacturer must be approved by Bosch.

4.7.2 Computers (GDS 5.2.5.1)

- Preferred Computer manufacturer is HP. Any alternate manufacturer must be approved by Bosch.

4.8 Gage Process and Machine Capability

4.8.1 Gage Process and Machine capability (GDS 6.3.1)

- Machine capability criteria will be agreed upon and approved by Bosch at time of quotation.\

4.9 Sign-off Check List

- The GDS sign-off check list will be used. Exceptions must be approved by Bosch Project Management.

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Appendix A SAFETY REFERENCES

Primary Safety References

American National Standards Institute (ANSI)

For Customer Service and
General Inquiries please call:
212-642-4900
Washington, DC Headquarters
1819 L Street, NW, 6th Fl.
Washington, DC, 20036
202-293-8020
<http://www.ansi.org/>

Occupational Safety and Health Administration (OSHA)

<http://www.osha.gov>

Michigan Department of Energy, Labor & Economic Growth (DELEG)

Michigan Occupational Safety & Health Administration (MIOSHA)
P.O. Box 30643
7150 Harris Drive
Lansing, Michigan 48909-8143
www.michigan.gov

Indiana Department of Labor

Indiana Occupational Safety and Health Administration (IOSHA)
402 West Washington Street
Room W-195
Indianapolis, IN. 46204
PH: (317) 232-2655
Fax: (317) 233-3790
www.in.gov/dol/iosha.htm

National Fire Protection Agency (NFPA) National Electric Code (NEC)

1 Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
617-770-3000
<http://www.nfpa.org/Home/index.asp>
<http://www.nfpa.org/nec/catalog/index.asp>

Secondary safety references:

American Conference of Governmental Industrial Hygienists (ACGIH)

1330 Kemper Meadow Drive
Cincinnati, Ohio 45240, USA
Customers/Members Phone: 513-742-2020
Administrative Phone: 513-742-6163
<http://www.acgih.org/home.htm>

United States Environmental Protection Agency (EPA)

[usepa.gov](http://www.epa.gov)

Toxic Substances Control Act (TSCA) Inventory

<http://msds.pdc.cornell.edu/tscasrch.asp>

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**Appendix B
COMPONENT REQUIREMENTS**

General Purpose Relays	"Cube" style DIN rail mount socket
Circuit Protection	Circuit breakers of appropriate rating are preferred over fuses
Power supplies	Sized with 30% extra capacity
Solenoid valves	24 vdc coil will be used
Emergency Stop Buttons	Mushroom head buttons with "turn to reset" functionality
<p>Amplified Pressure transducers (24 vdc excitation voltage)</p> <p>(Use case for grounding shield where grounding location is appropriate.)</p>	<p>¼" NPT thread fitting</p> <p>A 6 pin amphenol connector, compatible with PT06A-10-6S(SR) with the following configuration shall be used</p> <p>Pin a + Excitation Pin b + Signal Pin c - Signal Pin d - Excitation Pin e Cal 1 Pin f Cal 2</p>
<p>Non-amplified Pressure transducers (10.00 vdc excitation voltage)</p> <p>(Use case for grounding shield where grounding location is appropriate.)</p>	<p>¼" NPT thread fitting</p> <p>A 6 pin amphenol connector, compatible with PT06A-10-6S(SR) with the following configuration shall be used</p> <p>Pin a + Excitation Pin b + Signal Pin c - Signal Pin d - Excitation Pin e Cal 1 Pin f Cal 2</p>
<p>4-20 mA Pressure transmitter (24 vdc excitation voltage)</p>	<p>¼" NPT thread fitting</p> <p>A 6 pin amphenol connector, compatible with PT06A-10-6S(SR) with the following configuration shall be used</p> <p>Pin a + Supply Pin b + Supply Pin c N/A Pin d N/A Pin e N/A Pin f Ground</p>
Thermocouples	Mini T/C connectors will be used
Liquid Tubing	Seamless (ASTM A-269) Stainless Steel tubing, grade 304 or 316 with minimum 0.035" wall thickness. In some instances, galvanized may be permitted. For brake

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	tubing automotive grade tubing is permitted.
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