FLORIDA STATE UNIVERSITY

PURCHASING DEPARTMENT

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ADDENDUM ACKNOWLEDGMENT FORM

DATE: August 13, 2009

ADDENDUM NO. 2 Competitive Solicitation Number **ITN 5340-3**

TITLE: Helium Refrigerator for Series Connected Hybrid at NHMFL

INSTRUCTIONS TO RESPONDERS:

Attached is additional information pertaining to the Competitive Solicitation. Please read this information carefully and incorporate it into the terms, conditions and specifications submitted with the original solicitation and any prior addendum's. This cover sheet must be signed by the individual signing the solicitation and returned with this solicitation.

CERTIFICATION:

This is to certify that I did receive the referenced addendum and have incorporated the terms, conditions, and specifications listed therein into the attached Competitive Solicitation.

_____

SIGNED

_____

TITLE OF ABOVE

References are to page number and section number and/or paragraph of the FSU specification.

1. General: We did not see contaminants (identities and quantities) listed. Please provide or indicate where given.

A: The refrigerator will be operated in a closed cycle. During the start of the refrigerator, the total impurity in the helium should be less than 5 ppm.
The refrigerator should be able to remove the contaminants introduced by the compressor or other components of the refrigerator in operation and be able to continuously run for more than 8000 hours. If the vendor has a special requirement for the helium, please specify in the response.
The vendor should propose how to purify the refrigerator before the first commissioning.

2. General: Is there a minimum on line time required or is it OK to design the purifiers and regeneration system so that the on line time exceeds the regeneration time (including cool down time) by a reasonable amount.

A: The vendor should make a proposal on the design parameters and usage of the 80K/20K adsorbers. The regeneration time (including warm up and cooldown time) of each 80 K adsorber should be less than the on-line time, which is given in the FSU specification 2.5.6.4.

3. Ref. page 16, sect. 2.1, top para.: "the 750 W refrigerator system (including -------), SCH magnet, CDB, transfer lines and 80 K coldbox are to be built at the NHMFL. Should this be "the 750 W refrigerator system (including -------) shall be supplied by the refrigerator Vendor. The SCH magnet, CDB, transfer lines and 80 K coldbox are to be built at the NHMFL."?

A: The 750 W refrigerator system shall be supplied by the refrigerator vendors. The CDB, transfer lines and 80 K coldbox may be built by NHMFL or other vendors. All of these are new equipment to be installed at the NHMFL.

4. Ref. sect. 3.5, 3.5.2.3, final site acceptance and plan by vendor. "Assumption is that final acceptance plan is proposed by vendor to replace provisional accept. Please confirm"?
A: OK. This is correct. Final acceptance will be made after the successful test at the NHMFL.

5. Ref. sect. 3.5.2.1, compressor mass flow rate to be measured during site acceptance test. Shop performance test of compressor includes mass flow measurement with test report, 1. Therefore delete this requirement or 2. All test equipment and test set-up and measurements to be within the scope of NHMFL. Please confirm.
A: The shop test report of the compressor is required. The final test of mass flow rate will be done in the final test at the NHMFL. The flow rate is measured with the flow meter, which will be installed and supplied by the buyer on the HP line between compressor and coldbox.

6. Ref. page 33, sect. 4.2.4: It is understood that the requirement is for the vendor is to design and propose one system meeting the specified performance criteria while using LN2 precooling and to report the performance of this system if operated without LN2 as opposed to designing a 2nd system to meet the performance requirements without LN2.

A: 750 W at 4.5 K is the requirement capacity for the helium refrigerator using LN2 precooling. The vendor should also provide the performance for this refrigerator without LN2 precooling.

7. It is not clear what the conditions of the returning streams are.

a. In the refrigeration mode, the 3rd paragraph on page 17 says the return helium after cooling the superconducting magnet returns to the CDB and then is liquefied in the LHe buffer in the CDB. Presumably, some cold gas is returned from the CDB to the refrigerator. What is the temperature, pressure and flow rate?

A: To understand it clearly, please refer to the P&ID (figure 2 in the specification). The pressure in the LHe buffer is not more than 1.25 bar. The return helium is saturated gas at the pressure of the LHe buffer. The return flow rate to the refrigerator is the same as the flow rate supplied by the refrigerator in the refrigeration mode.

b. Similarly, we should have return gas conditions for the other modes.

A: For the liquefaction mode, the return flow rate = the supply flow rate – liquefaction rate. For the cooldown and warm up modes, they are explained in the FSU specification 2.2.4.

8. Ref. 2.6, diagram shows DSC access to Operator Panel. Why DCX does not directly access the PLC? Suggest to use MODBUS TCP for signal exchange between DCS and PLC.

A: OK. MODBUS TCPIP or other industrial standard bus communication directly to DCS can be offered by the Vendor. The operator panel for the refrigerator should be supplied by the Vendor.

9. Ref. 2.6.6.10, gas analyzer. Assume there shall be only one sample point at the oil adsorber outlet. NHMFL to confirm this.
A: The NHMFL needs one analyzer and at least 3 manual sample points: oil adsorber inlet, oil adsorber outlet and inlet of helium make-up valve (connected to the He storage tank). Normally the analyzer monitors the impurity continuously at the oil adsorber outlet. The vendor should recommend whether any other sample points are needed.

10. Ref. 2.6.6.10, 3.5.2.1, gas analyzer. Vendor's analyzer can measure N2, H20, CxHy and aerosols. O2 can be estimated based on N2 measurement. Is a N2 analyzer required?
A: It is fine to use the vendor's analyzer for the measuring of N2, H2O, CxHy and aerosols. An O2 estimation from the N2 measurement is acceptable.

11. Para. 2.5.6.12 – Please define your requirements a reason for an internal purifier? Additionally, what are the contaminates and what is the purification level required?

A: The internal on-line adsorbers are used for the removal of impurities in the case of external helium which enter the closed refrigeration system and may introduce impurities into the system or where the impurities accumulate over long term operation. The internal adsorbers are for the safety and reliability of the refrigerator in long term operation. For example, if there is a quench of the magnet, the helium in the cryogenic system will be vented to the air. Then the magnet will be cooled down again and the external helium will enter into the cryogenic system. Regarding the contamination, this is explained in the answer to question 1 & 2 above.

12. What are the building constraints for the Cold Box (i.e. ceiling height, floor space area, etc.)?

A: The ceiling height of the building is 4.5 meters. The vendor should define the required floor space area for the compressor, the coldbox, etc, including working access.

13. Ref. 2.5.4, comply with all relevant USA Codes & Standards. Applicable Standards & Codes need to be defined and listed.

A: Applicable standards and codes: 1. ASME Boiler & Pressure Vessel Code; 2. ASME B31.3 Code for Pressure Vessel Piping;3. OSHA Occupational Safety and Health Administration; 4. IEC & IEEE, Electrical wiring and equipments applicable standards, IEEE 519 covers the specification for harmonics produced by variable frequency drives. The compressor should be UL listed. Equipment should also conform to the latest version of the NEC code.

14. Ref. 2.5.5.3, vibration dampers. Please provide minimum vibration requirement.
A: The vendor should propose their standard vibration reduction system along with the vibration specification with this fitted.

15. Ref. 2.5.6.5, charcoal replacement of 80K / 20K adsorbers. Charcoal replacement of adsorbers in general not required, possible at warm condition and opening of coldbox.
A: It is good if the charcoal replacement is not required. If it needs replacement after long term operation, this will be done at room temperature. The vendor should show how to do it.

16. Ref. 2.5.7, Linde PLC system to start recovery compressors. Need clarification for PLC system to start recovery compressors.
A: The recovery compressors will be started by the buyer's DCS system or Buyer's PLC, not the Vendor's PLC.

17. Ref. 2.5.9, terminal blocks installed in a hemetic box. Please explain requirement.
A: The terminal box should be a normal control cabinet, which is protected against the ingress of dust, water, oil etc. (NEMA 12 enclosure).

18. Ref. 2.6.7, local gauges at coldbox. Coldbox shall be supplied without local pressure gauges. Need acceptance.
A: This is acceptable. The pressure of the adsorbers and other necessary parameters should be readable at the operator panel and by the DCS. The Vendor should define what is included in the proposal.

19. Ref. 2.8, operation modes of cryogenic refrigerator. Please describe the amount of controls and interaction of the refrigerator PLC for the sub-cooler/distribution box during the different operation modes.
A: The interaction of the vendor's PLC and NHMFL's DCS should be defined clearly by the vendor and NHMFL in detail. Controls that should be provided by the Vendor's PLC include: 1. The cooldown, warm up and 4.5 K operation of the magnets with Buyer providing signals defining the pressure and the temperature requirements. 2. The refrigerator should protect itself during cooldown, PS trip, quench, and loss of power. 3. The control of CV111 for the steady operation of the refrigerator (Buyer give the opening position signal of CV111). 4. The refrigeration capacity adjustment for varying heat load which is controlled from a signal provided by the Buyer (the signal is the required % of the full capacity).

20. Ref. 2.1, refrigeration of 750W @ 4.5K either with or without LN2 pre-cooling. Clarify that 750W at 4.5K is with LN2 pre-cooling. LN2 pre-cooling has definite impact on the plan size and location of internal adsorbers.
A: 750 W at 4.5 K is with LN2 precooling, shown in the specification 2.5.6.2.

21. Ref. 2.1 vs. 2.2.1, 2.3, In the introduction 210 W for SCH magnet and 350 W for 45T magnet are specified, while in the later sections 2.2.1 the fluid properties indicate altogether 193 W for the 45T

magnet and 175 W for the SCH magnet; we suppose there are 20% design margin included.
What is the reason for the specified 750 W refrigeration load? Please clarify.
A: The average heat load of SCH is 210 W at 4.5 K, which has 40% design margin. The equivalent heat load of 45 T is 350 W, which is calculated from the present operation parameters. The 750W refrigeration load specified includes additional capacity in order to support other laboratory requirements. For example, we intend producing LHe 60L/hour with this refrigerator.

22. Ref. 2.2.2, ...managing of varying loads with an electrical heater, mounted in the LHe Buffer. For higher energy efficiency we propose to manage varying loads by means of a frequency inverter of the main compressor and high pressure reduction. A signal exchange between CDB and Refrigerator is therefore necessary.
A: This is acceptable and the Buyer will give the required percentage (60% -100%) of the full capacity.

23. Ref. 2.5.6.7, cooldown mass flow is specified. Mass flow to be controlled by means of valves and measurements in CDB in buyers scope of supply?
A: We agree. The refrigerator should be designed to have such refrigeration capability during cooldown, which is shown in the FSU specification.

24. Ref. 2.5.6.8, return pressure from 45 T magnet (1.2 bar, see 2.3) must be higher than LHe Buffer pressure (1.25 bar).
A: Yes, this is correct. The return pressure of 45 T magnet is a little above 1.25 bar.

25. Ref. 2.5.7, "The command for the start and stop of recovery compressor shall be given by the refrigerator PLC". As the recovery compressor will primarily be used in case of a quench and the CDB, magnet - system as well as the recovery compressors are in buyers scope of supply, we propose that the command for start/stop of the recovery compressor is given by buyers PLC instead of the refrigerator PLC. The refrigerator will give a shut-down signal as well as "ready"-signals.
A: This is acceptable. The recovery compressors will be started by the Buyer's PLC or DCS, not the Vendor's PLC.

26. Ref. 2.7.2, “A refrigerator fail-safe analysis report…” Vendor usually provides a HAZOP analysis as well as CFC (continuous function charts) for the control logic that incorporate interlocks.
A: OK

27. Ref. 2.8, There are altogether 9 operation modes specified which is quite complex to control. We propose to reduce the number of operation modes to the following:
1) Mode 1: Cold Mode incorporating the specified modes 1, 2, 5, 6, 7
2) Mode 3 as specified
3) Mode 4 as specified
4) Mode 8 and Mode 9 after a thorough discussion as the refrigerator will not be able to cope with unlimited amount of cold return gas
A: The number of modes is for system description purposes. If modes are operationally equivalent they may be combined in PLC programming. The system must function in all 9 operation modes specified by the buyer though some of those modes may be combined to fewer configuration setups in the refrigerator. For mode 8 and mode 9, the refrigerator should protect itself. The refrigerator should have a restricting valve on the return line for the flow rate to allow it to keep continuously running. The Buyer will take responsibility to vent the excess helium from the LHe buffer.

28. Ref. 2.6.6.10, “gas analyzer … interlock signal. We would not recommend to use an analyzer

signal as interlock signal.
A: The Vendor should explain in detail how the refrigerator would be protected from contaminants.