STAR Main Hydraulic System Specification

Brookhaven National Laboratory
Associated Universities, Inc.
STAR Collaboration
SPEC. No.: 280
Issue Date: 01/27/97
Rev. No.: A
Rev. Date: -
Title: STAR Main Hydraulic System
QA Category: A-3

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REVISION RECORD

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STAR DETECTOR
STAR Main Hydraulic System
Specification & Statement of Work

Specification #280

1. General

1.1 Summary — This specification defines the operational characteristics, vendor responsibilities, quality assurance requirements and statement of work for the STAR hydraulic lift and translation system.

1.2 System — The system consists of a portable wheeled cart containing the pump, controls, position readouts, reservoir and associated plumbing as well as the items located on the STAR detector including 4 existing vertical lift jacks, 2 horizontal translation jacks, 4 verticle and 2 horizontal position tranducers, servo valves, plumbing and manifolds. (see fig. 1)

The cart will be connected to the detector via forty foot long hydraulic supply and return flex hoses equipped with quick disconnect fittings and the same length of electric control cables. (see fig. 1)

1.2.1 The following documents & standards are part of the specification:

ASME B30.1
BNL QA - 101 (Sept. '93 rev.)
MAG412-C-1A
MAG421-C-1A

1.3 System requirements

1.3.1 Separate horizontal and vertical systems

Within the STAR detector, the horizontal and vertical systems are completely separate, each with its own labeled input and return manifolds so that the horizontal and vertical functions can never be performed simultaneously.

1.3.2 Position Transducers & Readouts

Each previously procured vertical jack shall have it's own absolute position transducer located next to the jack and a readout that can be zeroed to an arbitrarily defined home position somewhere along the stroke and measure extension or retraction from that zero home position to an accuracy of ±.005 inches over the full range of travel. Full travel is 2 inches for the vertical jacks and 62 inches for the horizontal. Vertical tranducers will reference detector motion with respect to ground rail plates (not jack extension). The horizontal jacks will have an internal transducer (see 1.3.10).

1.3.3 Jack synchronization and jogging moves and auto stop

Normally when a vertical or horizontal move is commanded, all four vertical or both horizontal jacks shall move together within ±.015 inches of each other over the entire commanded stroke. If this criteria is not met the entire drive shall stop automatically with a fault location indication. In addition each jack shall be able to be jogged independently of the others. In the jogging mode the max. allowable difference criteria (±.015 inches) is disabled.

1.3.4 Position readout zero and memory function

Readouts for all jacks shall be able to be zeroed at any point within the stroke so that subsequent moves are measured from the zeroed position. In addition it is preferable for the horizontal jack readouts to accumulate position readings and be able to display the accumulated motion from the original home position.

1.3.5 Control Features

The speed, direction and distance of all synchronized moves must be preset prior to initiation. Initial flow to any cylinders shall not be greater than 0.2 gpm and subsequent rate of change of flow to any cylinder shall not be greater than 1 gpm/sec if ramped automatically. If speed is manually controlled, an interlock shall prevent flow to the cylinders unless the flow speed control is initially set to zero.

When the distance of a move is pre-set, the unit shall automatically stop when one of the readouts indicates that the desired distance has been achieved.

1.3.6 Readout locations & display units

The position readouts will be located next to each other with the four vertical readouts grouped together in a square pattern and the two horizontal units displaced horizontally from each other. At the operator's discretion display units should be inches or millimeters for the vertical and inches, centimeters, meters or feet for the horizontal. The display should indicate whether the horizontal or vertical drive is active and it's direction as either up, down, north or south.

1.3.7 Emergency stop functions

A large prominent emergency stop button shall be provided which will stop all motion when activated. Each jack shall be equipped with normally closed valves at the jacks to prevent motion in the event of a power failure.

1.3.8 Pump Capacity, system proof pressure & pressure relief

The pump shall have a capacity of at least 6 gpm at 5000 psi, in addition, it is desirable that the pump be capable of a flow capacity of at least 24 gpm at a pressure greater than 15 psi. The pump output shall have a pressure relief valve set at 5000 psi and a pressure gauge with a full scale reading of 10,000 psi. The system shall be able to withstand an internal pressure of 10,000 psi

(proof pressure) without damage or leaks except the horizontal jacks (see below) which will be protected by relief valves set to 3,000 psi.

1.3.9 Reservoir capacity & hydraulic fluid

The system shall have a reservoir located on the portable cart of at least 40 gallons. The hydraulic fluid shall be QUINTOLUBRIC 822 from QUAKER CHEMICAL or equivalent.

1.3.10 Horizontal Jacks

The two horizonal jacks shall be standard, commercially available items if possible with a stroke length of 62 inches, a suggested bore of 8 inches, a rod diameter of 5.5 inches, a maximum pin to pin retracted length of 112", and a proof pressure rating of 3,000 psi, and meet the requirements of ASME B30.1 - 1992.

These jacks must be able to apply at least 100,000 lbs push (or compressive) force and 53,000 lbs pull (or tensile) force over the entire stroke lenght. An absolute extension encoder shall be incorporated into each jack which will enable the system to meet the requirements of 1.3.2 and 1.3.3. The rod end and cylinder base fittings shall be designed to mate with the brackets shown in MAG412-C-1A and MAG 421-C-1A respectively.

1.4 Statement of work

1.4.1 Scope

The following outlines the sellers responsibilities with regard to materials procurement, shipping, installation, testing, performance demonstration, and documentation.

1.4.2 The Seller Shall

1. Procure all items (except the vertical lift jacks which are at the buyers Facility) necessary to perform the functions outlines in paragraph 1.3 above. (Buyer will provide description of vertical jacks to prospective sellers)

2. Assemble the individual components into the working portable system.

3. Deliver all items to the buyers facility in good working order.

4. Program controller to perform the functions as outlined in paragraphs 1.3.2 thru 1.3.7.

5. Demonstrate system operation and performance to the requirements of paragraph 1.3.

6. Instruct BNL personnel in the operation and maintenance of the entire system including hardware and software and provide written procedures for same.

7. Provide all documents such as repair manuals data sheets, parts lists, operational limitations and software documentation necessary for the operation and maintenance of the system, i.e.: owners operation manual.

1.5 Proposal Submittal

Prospective sellers shall submit a proposal as to how they intend to meet the performance objectives of Paragraph 1.3. This proposal should include, as a minimum, a system schematic with specific components called out including manufacturers and model numbers. It should also include an operational description from power up to shut down which describes how all vertical and horizontal move functions are performed.

1.6 Performance Evaluation

The buyers engineering representatives will evaluate the systems performance as demonstrated by the seller in 1.4.3 above and shall have the authority to accept or reject the demonstrated performance. Any changes deemed necessary to meet the performance objectives of paragraph 1.3 shall be submitted to the buyer engineering representatives for evaluation.

1.7 Quality Assurance Provisions

Articles furnished in compliance with this specification shall be produced under the controls established herein and as required by the applicable contract. Additional Quality Assurance requirements are in accordance with BNL-QA-101; Sections 1, 2, 3 (including 3.1.3), and 4.14, 4.16, 4.31, 4.37, 4.38 .