C-A D Engineering Design Support Documentation Cover Page

Document number: 3A995009 QAR-02	
Title: Run 2007 Hx-20 inspection and bypass line equivalence Close-out Memo	**Author**: R. Than / D. Lederle
Subject: RHIC	
C-A Department Group: Cryogenic Systems Group	**Approval**: R. Than
Documentation Type **[ ] Written Technical Paper** **[ ] Design Calculations** **[ ] Design Review Presentation** **[X] Design Certification** **[ ] Specification** **[ ] Procurement Documenation** **[ ] Safety/ALARA Review Presentation** Other	**Equipment Type** **[ ] Magnets and Power Supplies** **[ ] Vacuum Systems** **[ ] RF Systems** **[x] Cryogenic Systems** **[ ] Experimental Equipment** **[ ] Beam Instrumentation** **[ ] Water Systems** **[ ] Buildings, Structures, and Shielding** Other
Equipment Location:	**Associated information for cataloging**
[ ] Tandem Van DeGraff	**[ ]** CA-D Design Room Job No.
[ ] Linac	
[ ] Booster	**[ ]** CA-D Design Room Drawing No
[ ] AGS	
[x] RHIC	**[ ]** CA-D Specification No
[ ] 912 Experimental Area	
[ ] 919 Experimental Area	**[ ]** CA-D Experiment No.
[ ] RHIC Experimental Area	
	[ ] Other
[ ] Buildings Structures, and Shielding	
Other	

BROOKHAVEN NATIONAL LABORATORY
COLLIDER-ACCELERATOR DEPARTMENT
CRYOGENIC SYSTEMS GROUP

Doc. No.: 3A995009-QAR-02
Issued Date: _12/12/2007__
Rev. No. A_____
Rev. Date: _____

Prepared by: ___R. Than / D. Lederle_____

During March of 2007 Run two pipe sections worked on, one was cut and re-welded, another pipe section was added as a bypass line to resolve operation problems in the cryogenic refrigerator.

The section of pipe that was cut-out for inspection of HX-20 inlet line and the by-pass line that was put in, were pressure tested during this summer shutdown, as part of pressure test on the low pressure side of the plant.

Pressure Test

This was done as part of pressure test IV and V (Test IV and V was combined) of the summer shutdown work. Pressure test report is excerpted from summer shutdown work report, 3A995009-QAR06-Appendix M.

APPENDIX A

EQUIVALENCE RULING Date:3-2-2007

At the RHIC cryogenic system in and proximate to 1005R, a pipe had to be removed and replaced to allow for inspection of a heat exchanger (HX20), and another pipe had to be added to run the heat exchanger (HX20) in parallel with heat exchanger HX8. A small window for RHIC operations exists between now and July 1, 2007, and millions would be lost in time and materials if the run were ended now due to a failed heat exchanger or due to human error during complex large-scale preparations for leak testing, which would involve removing burst disks and locking out relief valves. The proposal is to pressurize the system to 10% below the system relief valve pressure instead of 110% of the maximum system design pressure for the leak test.

The calculated stress on the bypass piping and welds at the maximum design pressure has a safety factor greater than 8 to 1 to the material yield stress. The calculated stress on the pipe that was cut and replaced for HX20 inspection has a similar safety factor. The bypass does not increase the stress on any other piping in the system. The system operates at less than 1/3 relief valve pressure. The piping has secondary containment to contain any energy released from a low probability pressure boundary failure. The vacuum enclosures and jackets on the piping act as secondary containment. Replacement and new piping welds will be dye-checked for cracks by Certified Welding Inspectors, and the system will be leak tested to almost three times operating pressure to confirm pressure boundary integrity. If a leak occurs, gases will be exhausted outside, away from people and the building, precluding oxygen deficiency. It is estimated a total of $40,000 worth of helium may be exhausted if the welds fail. Because secondary containment provides equivalent safety, there are no personnel safety issues.

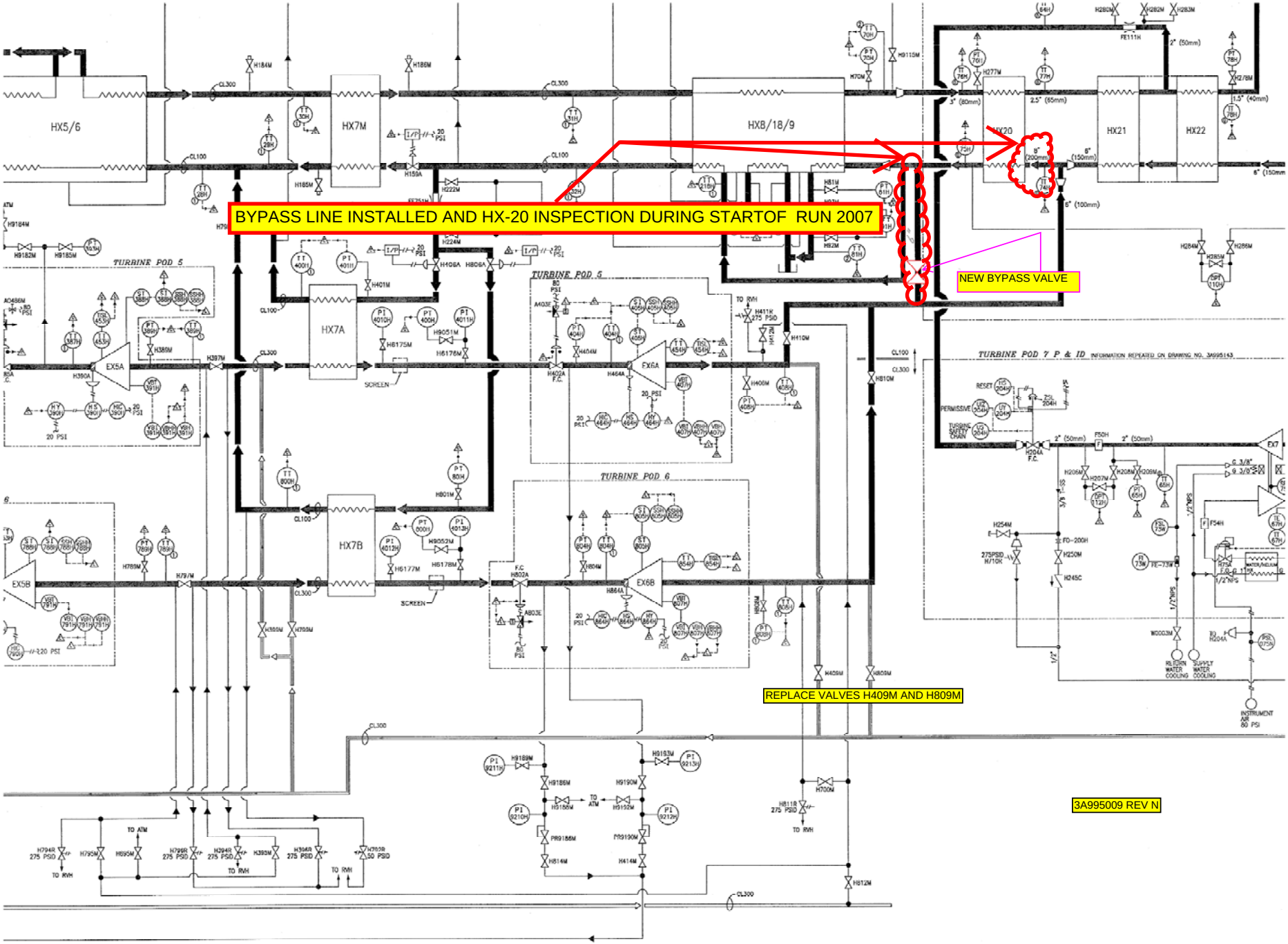
Regarding equivalence to the Code (ASME B31.3, Section 323.1) for materials, 304L stainless steel is exempt from impact testing to 20K (ASME Boiler & Pressure Vessel Code, Section VIII). Impact testing at 4K has been shown to be impossible to perform. RHIC has extensive experience with the weld procedure, and it is qualified to ASME. The entire RHIC cryogenic plant is welded 304L stainless steel piping, and this piping has not had any failures or indications of near failures during 8 years of operations.

Parts of Code requiring equivalent safety: ASME B31.3-2002, Section 341 Examination, Paragraph 345.1 Required Leak Test and Paragraph 345.9 Alternative Leak Test and Section 323.1, Materials.

This ruling is temporary and will expire at the onset of RHIC Shutdown for FY2007, at which time the leak testing will occur.

S. Kane, J. Tuozzolo, R. Karol, E. Lessard

APPENDIX B: LOCATION HX-20 BYPASS AND INLET ELBOW


BYPASS LINE INSTALLED AND HX-20 INSPECTION DURING STARTOF RUN 2007
NEW BYPASS VALVE
REPLACE VALVES H409M AND H809M
3A995009 REV N
HX5/6
HX7M
HXB/18/9
HX20
HX21
HX22
HX7A
HX7B
TURBINE POD 5
TURBINE POD 6
TURBINE POD 7 P & ID
EX5A
EX6A
EX5B
EX6B
EX7
TO RVH
TO ATM
SCREEN
INSTRUMENT AIR 80 PSI

APPENDIX C: PRESSURE TEST REPORT, Excerpt from Summer shutdown report 3A995009-QAR06- Appendix M

PREPARED BY: Mark Sardzinski
CHECKED BY: Dewey Lederle

EQUIPMENT: **TEST IV: Procedure because of valve leakage test V was added.**
Pressure check H509M drain (between HX4 & HX5/6)

CLOSE VALVES:

- **H380A**
- **H780A**
- **H153A**
- **H744A**
- **H344A**
- **H157M**
- **H798M**
- **H398M**

Note: H153A leaks CLOSE: H313M H713M H341M H741M

DISCONNECT AND BLOCK:

- **H18R**
- **H21R**
- **H240R**

1. Vent piping via H509M.
2. Verify piping to be tested is vented, take print out of area .
3. Connect hose from trailer to H509M.
4. Pressurize to 88 psig hold pressure then drop the pressure to MAWP for 10 minutes for leak testing.
5. Monitor the refrigerator for leakage into non-test areas. Also monitor vacuum gauges on the cold boxes.
6. Take print out of test area.
7. Depressurize system.
*****NOTE: if leakage is excessive STOP TEST and evaluate, retest.*******
MAWP: 50 psi
DESIGN TEMPERATURE:
TEST TYPE: PNEUMATIC
TEST PRESSURE: 88 psig
TEST MEDIUM: Helium gas
TEST DATE: 9/25/2007
RESULTS OF TEST: Passed
TEST PERFORMED BY: C. Salat & M. Sardzinski **DATE**: 9/25/2007
TEST WITNESS BY: Jim Durnan (safety engineering) **DATE**: 9/25/2007
COMMENTS: During test CB 4, 5 and 6 vacuum was monitored , no indication of leaks.

BROOKHAVEN NATIONAL LABORATORY

Collider-Accelerator Department/Cryogenic systems

PRESSURE TEST DATA SHEET

DATE: 9/20/2007

DEPT/GROUP: CRYOGENICS SYSTEM
DIVISION: COLLIDER - ACCELERATOR

PREPARED BY: Mark Sardzinski
CHECKED BY: Dewey Lederle

PROJECT:
EQUIPMENT: New piping/valves installed. See test procedure below.
DRAWING NO:
ASSEMBLY: 3A995009 (Refrigerator)

General Statements:

1. All work in the test area must be stopped.
2. All process piping (refrigerator) shall be vented to atmosphere.
3. Verify that all relief valves and burst disc's(see list) be removed and piping capped.
4. Building entry points to be guarded during test.
5. The general LOTO for the refrigerator may be disabled during the test.
6. If the piping that is being tested is enclosed in a vacuum jacket, the vacuum space must be monitored.
7. Pressurized trailer, hose, regulator and calibrated gauge must be available.
8. When pressurizing the test area(s), pressurize to *40 psig* and hold and evacuate the building. Continue pressurizing in steps to be determine in the field.
9. Record each test on the data sheets.
10. PPE required; safety shoes, eye protection, long sleeve shirt and long pants (no shorts).

PREPARED BY: Mark Sardzinski
CHECKED BY: Dewey Lederle

EQUIPMENT: **TEST V: Procedure**

Pressure check H510M, H511M, H512M, H122A, H90A and capped line in zone D8 , H290M .

CLOSE VALVES:

- **H159A**
- **H810M**
- **H410M**
- **H38A**
- **H40A**
- **H450M**
- **H200M**
- **H87M**
- **H89A**
- **H95A**
- **H100A**
- **H125M**
- **H 54A**
- **H449A**
- **H437A**
- **H58A**
- **H406A**
- **H806A**
- **H798M**
- **H398M**
- **H88M**
- **H131M**
- **H33A**

OPEN VALVES:

- **H159A**
- **H290M**
- **H122A**
- **H90A**
- **H114A**
- **H106A**

PREPARED BY: Mark Sardzinski
CHECKED BY: Dewey Lederle

DISCONNECT AND BLOCK:

H141R (because H58A leaks)
H68R
H52R
H48R
H67R
H51R

REMOVE BURST DISCS note: cross over valve must be closed and seated.
H160R
H60R /H27R
H98R /H59R
H46R / H97R
H111R/H56R

1. Vent piping via H510M.
2. Verify piping to be tested is vented, take print out of area Middle and Cold end) .
3. Connect hose from trailer to either H511M or H512M.
4. Pressurize to 88 psig hold pressure then drop the pressure to MAWP for 10 minutes for leak testing.
5. Monitor the refrigerator for leakage into non-test areas. Also monitor vacuum gauges on the cold boxes.
6. Take print out of test area.
7. Depressurize system.
*****NOTE: if leakage is excessive STOP TEST and evaluate, retest .*****

MAWP:
DESIGN TEMPERATURE:
TEST TYPE: PNEUMATIC
TEST PRESSURE: 88 psig
TEST MEDIUM: Helium gas
TEST DATE:
RESULTS OF TEST: Test results and comments are the same as test IV
COMMENTS:
TEST PERFORMED BY: **DATE**:
TEST WITNESS BY: **DATE**: