

MECHANICAL SHOCK ARRESTORS
SERVICE LIFE EXTENSION PROGRAM
&
PREVENTIVE MAINTENANCE RECOMMENDATIONS

Basic-PSA

Design Report

1.0 SCOPE

The intent of this document is two-fold. Primarily, this Program identifies the methodology, preventive maintenance outline and acceptance criteria recommended to extend the service life of PSA mechanical shock arrestors beyond their originally designed effective service life of forty years. The Service Life Extension Preventive Maintenance Plan outlined within this Program is intended to be used in conjunction with the Utility's Functional Testing and Service Life Monitoring Programs.

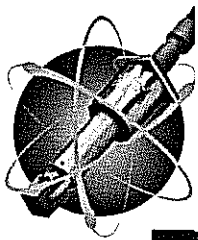
Secondly, this same methodology can be applied by those snubber program administrators wishing to develop a preventive maintenance schedule for PSA mechanical shock arrestors still within their forty year service life. The guidance provided here will enable you to determine the appropriate maintenance required for the installed mechanical snubbers based on the actual operating conditions present at the component support locations.

2.0 DOCUMENTS AND STANDARDS

The design of mechanical shock arrestors and attachments shall be in conformance with the applicable requirements of the ASME Boiler and Pressure Vessel Code standards identified in DR 1319, Section 2.

3.0 METHODOLOGY

- 3.1 Design - The design of PSA mechanical shock arrestors (snubbers) and attachments, covered under DR 1319, shall be in accordance with ASME B&PV Code, Section III, Division 1, Subsection NF, Sub-article 3200 or 3300.
- 3.2 Life - The snubber life was defined under DR 1319 as 40 years, with **appropriate maintenance** and operation within the rated load and environmental limits specified in Sections 5.3 and 5.4 of DR 1319. DR 3020 will act as a supplement to DR 1319 in providing guidance as to what is considered "appropriate maintenance".
- 3.3 Actual Operating Environment – In reality, the actual operating environment of a snubber varies considerably with each component support location. Experience has shown that the snubber will approach a degraded state more quickly the more hazardous the environment is with respect to vibration, temperature, humidity and other environmental considerations. The course of action taken to extend snubber service life



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is dependant on the classification of the component support location. Classification can be determined using data obtained from drag testing as outlined in Section 3.4.

- 3.4 Component Support Classification – Many nuclear operating facilities implement some form of service life monitoring within their snubber programs. Review of this data should enable classification of each component support location as outlined below. In the absence of such data, snubber locations can be classified based on the results of a drag test as follows:

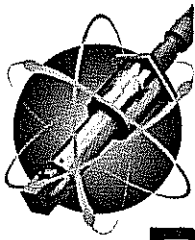
DRAG TEST RESULTS (% of rated load)	COMPONENT SUPPORT CLASSIFICATION
• $\leq 2\%$	LEVEL 1 LOCATION
• $> 2\%, \leq 5\%$	LEVEL 2 LOCATION
• $> 5\%$	LEVEL 3 LOCATION

Once the snubber locations have been grouped, the monitoring requirements specific for each classification can be implemented as follows:

LEVEL 1 LOCATION – (BENIGN) Snubbers within this group are not expected to see significant degradation over time. Periodic functional testing should be continued as required by the utility. No scheduled maintenance is required.

LEVEL 2 LOCATION – (DEGRADED) Snubbers within this group are considered degraded. The Service Life Extension Preventive Maintenance Plan outlined in Section 4 should be implemented. The snubber locations identified become sensitive areas, subject to increased monitoring frequency.

The monitoring frequency determined by the utility should be chosen to ensure that the snubber location does not degrade further to a Level 3 location (see below). Component supports identified as Level 2 may or may not all have the same monitoring frequency.



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LEVEL 3 LOCATION – (FAILED) Snubbers within this group are considered failures. The Service Life Extension Preventive Maintenance Plan outlined in Section 4 should be implemented. Snubbers installed in these locations are considered to have a high potential for degradation, and as such are separated from the rest of the snubber population for close monitoring every outage.

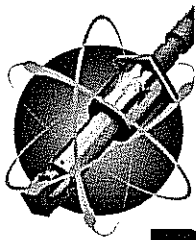
4.0 SERVICE LIFE EXTENSION PREVENTIVE MAINTENANCE PLAN

Snubbers installed in Level 2 and Level 3 locations have been identified as requiring more frequent monitoring and inspection due to potentially hazardous operating conditions. Periodic hand stroking evaluations of snubbers in these locations will ensure free movement between the monitoring intervals recommended in Section 3.4.

The actions required by this section of the Program shall be implemented by individuals trained by the Original Equipment Manufacturer (OEM) in the teardown, rebuild and failure analysis of PSA mechanical snubbers in accordance with Basic-PSA, Inc.'s Regreasing, and Repair and Overhaul Instruction Manuals.

The Service Life Extension Preventive Maintenance Plan requires the following actions:

1. As-found functional test.
2. Disassembly.
3. Inspection.
4. Degrease of parts.
5. Identify degraded parts.
6. Perform failure analysis as required.
7. Replace degraded parts as required.
8. Regrease with PSA NRRG-159 or PSA NRRG-2 (recommended) grease. Grease comparison curves are provided as an attachment to this document. (Equivalency statement available at <http://www.basicpsa.com>)
9. Reassemble snubber.
10. As-left functional test.



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5.0 ACCEPTANCE CRITERIA

Snubbers taking part in the Service Life Extension Preventive Maintenance Plan shall meet the following acceptance criteria during as-left functional testing:

Drag Force – The force required for axial movement of the snubber ideally shall not exceed two percent (2%) of the rated load.

Individual utilities may choose to accept a drag force test between two and five percent (2% – 5%), committing to increased monitoring of the subject snubber.

Acceleration – The snubber shall limit telescoping acceleration to .02g maximum.

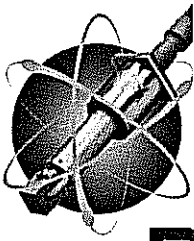
Individual utilities may choose to specify other limits on acceleration based on plant specific criteria.

6.0 CONCLUSION

It is not expected that snubbers located in Level 2 and Level 3 locations will require overhaul and failure analyses at every recommended monitoring interval as outlined in Section 3.4. Nor should it be interpreted that snubbers in Level 1 locations will never require overhaul. The intent of this Program is to ensure, with confidence, the operability of each snubber for the extended life of the facility. By classifying each component support location by the severity of its' respective operating conditions, this Program will implement a monitoring and inspection schedule for the installed snubber commensurate with the severity of service. In this way, the Service Life of a snubber at a particular location can be extended to the next monitoring interval indefinitely.

It is possible that a snubber may reach the end of its forty year design life without ever having been subjected to any maintenance activities; that is, the subject snubber was installed in a Level 1 location. As long as the snubber continues to test as a Level 1 location ($\leq 2\%$), no scheduled maintenance is required. The utility may, at its discretion, choose to replace the NRRG-159 grease with the improved NRRG-2 grease within the unit.

Should a new or reconditioned snubber be installed at the facility, its' monitoring and inspection requirements should follow this Program for ease of scheduling and to ensure appropriate maintenance.



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Prepared By:

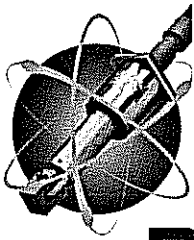
Patricia D. Huber
Chief Engineer
1/10/06

Approved By:

William Louder
President
1/10/06

Attachment:

NRRG-2/NRRG-159 Grease Comparison Curves



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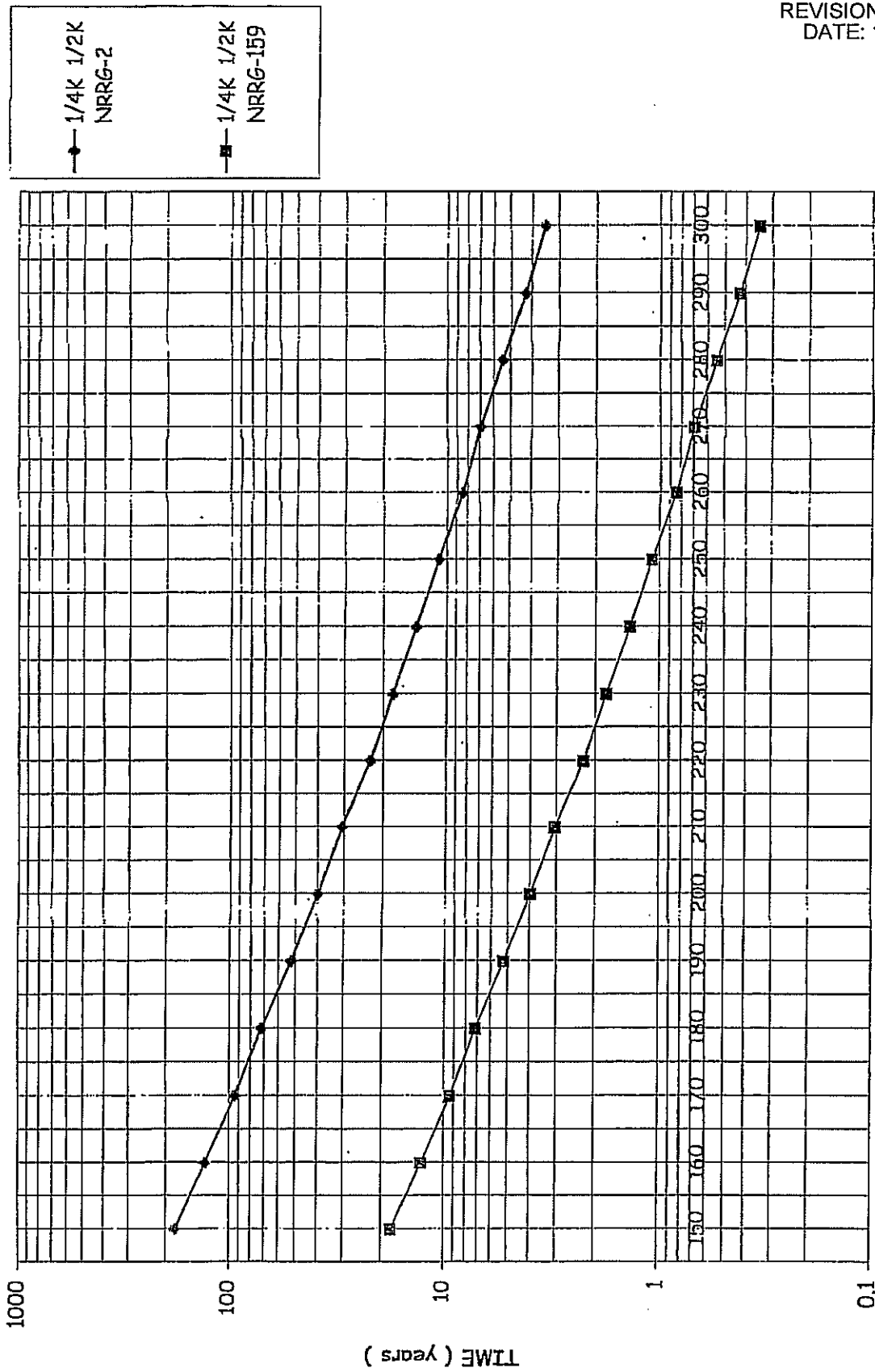
NRRG-2/NRRG-159 GREASE COMPARISON CURVES

The following grease curves compare Basic-PSA, Inc.'s NRRG-2 grease to the Chevron NRRG-159 grease. The curves are specific to snubber model type, and show the grease life expectancy versus temperature for the two greases.

These data curves represent the point at which the subject grease may begin to show a reduction in lubricity. Note that for both greases, as the temperature is increased, the time at which the subject grease may begin to degrade decreases. In comparing the two curves it can be seen that Basic-PSA, Inc.'s NRRG-2 grease maintains its' integrity better than the NRRG-159 grease.

These are not pass or fail curves, but a guideline for the user to help predict and plan your scheduled maintenance work. The snubbers' expected service life should be much longer than the curves predict, but we have chosen to be on the conservative side of 1% drag test acceptability for safety's sake.

PSA 1/4 PSA 1/2 NRRG-2 NRRG-159 TIME vs TEMPERATURE



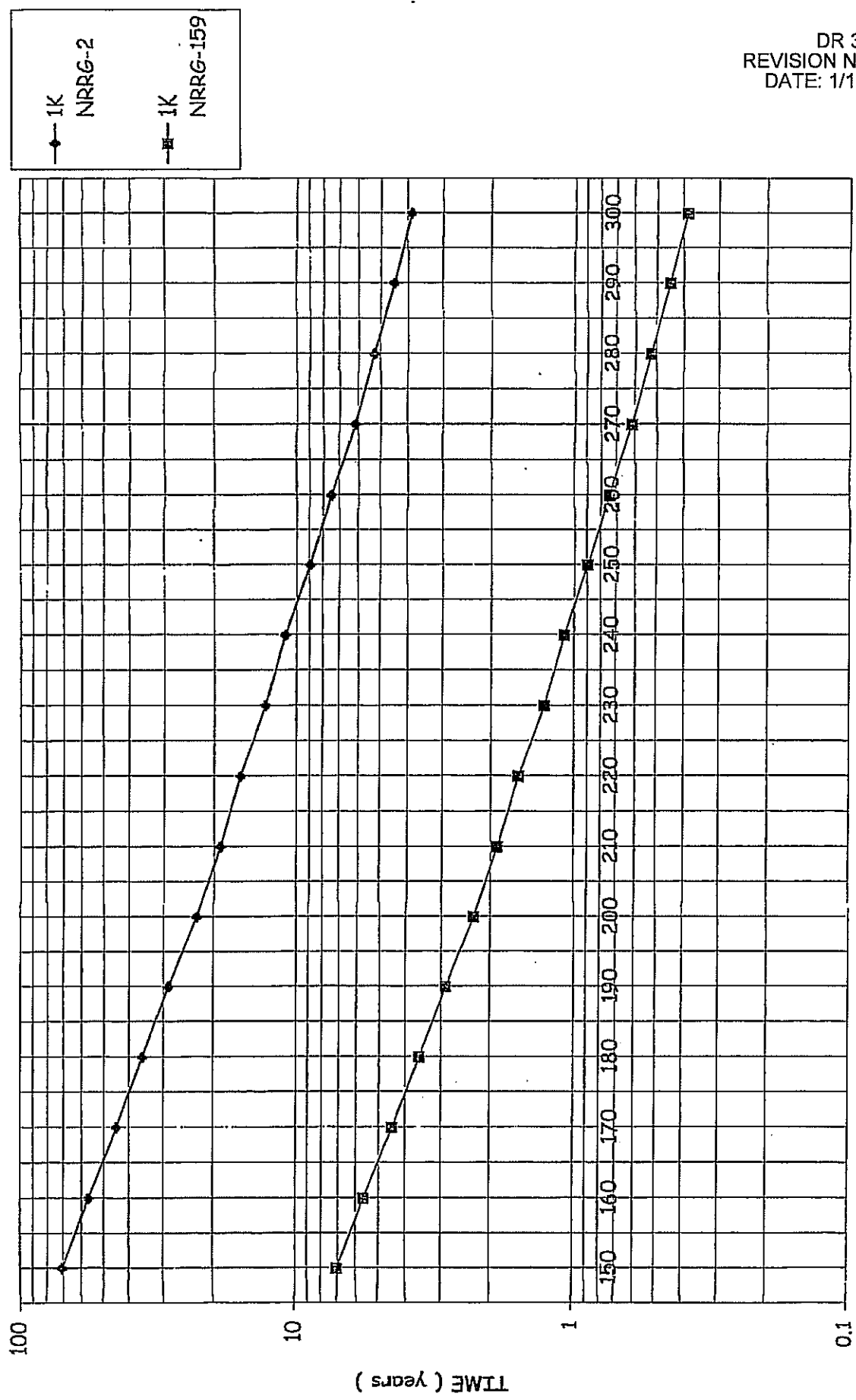
DR 3020
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1/22/02 Rel

TEMPERATURE (degrees F)

TIME (years)

PSA 1 NRRG-2 NRRG-159
 TIME VS TEMPERATURE

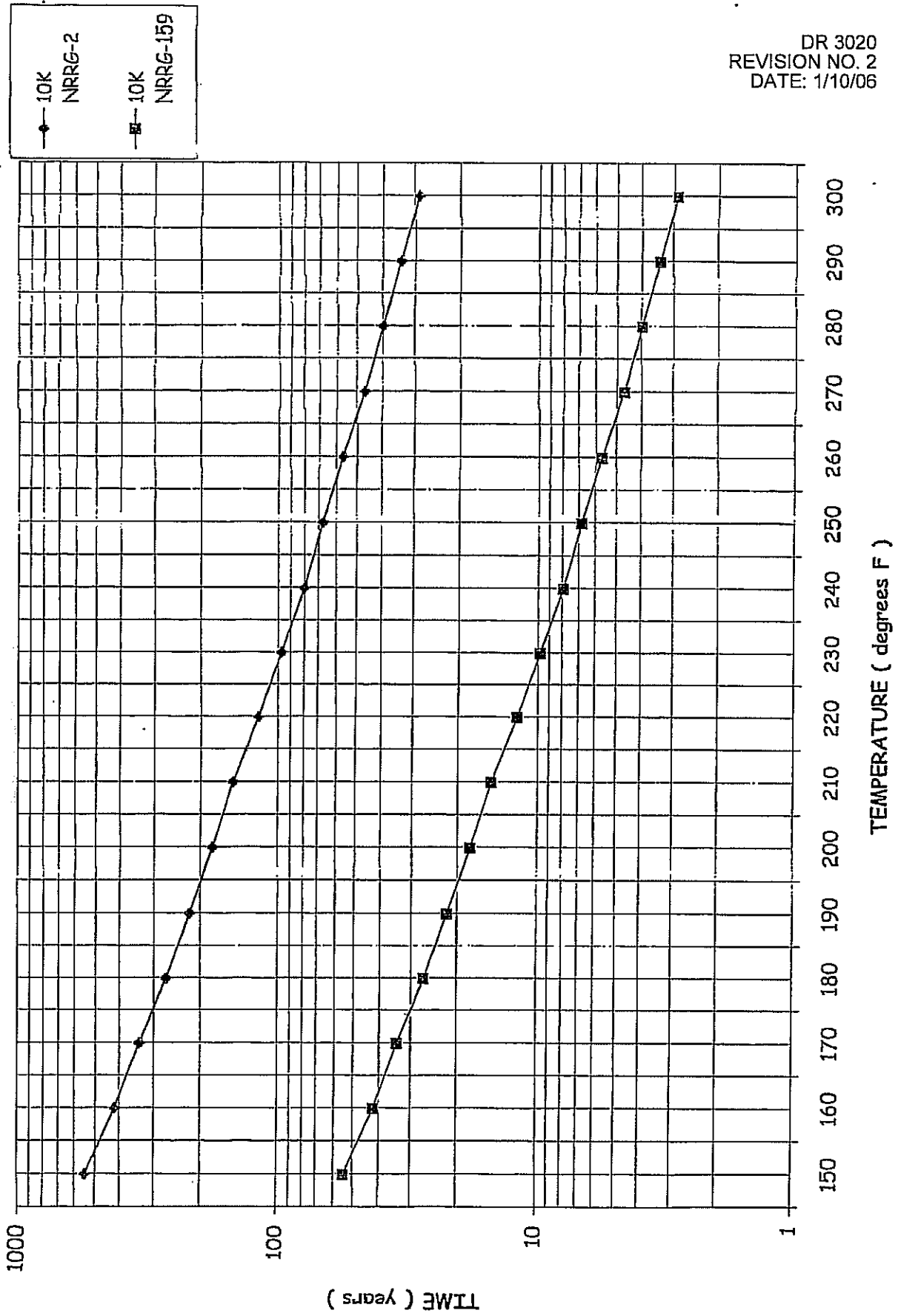


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TEMPERATURE (degrees F)

PSA 10 NRRG-2 NRRG-159
 TIME vs TEMPERATURE

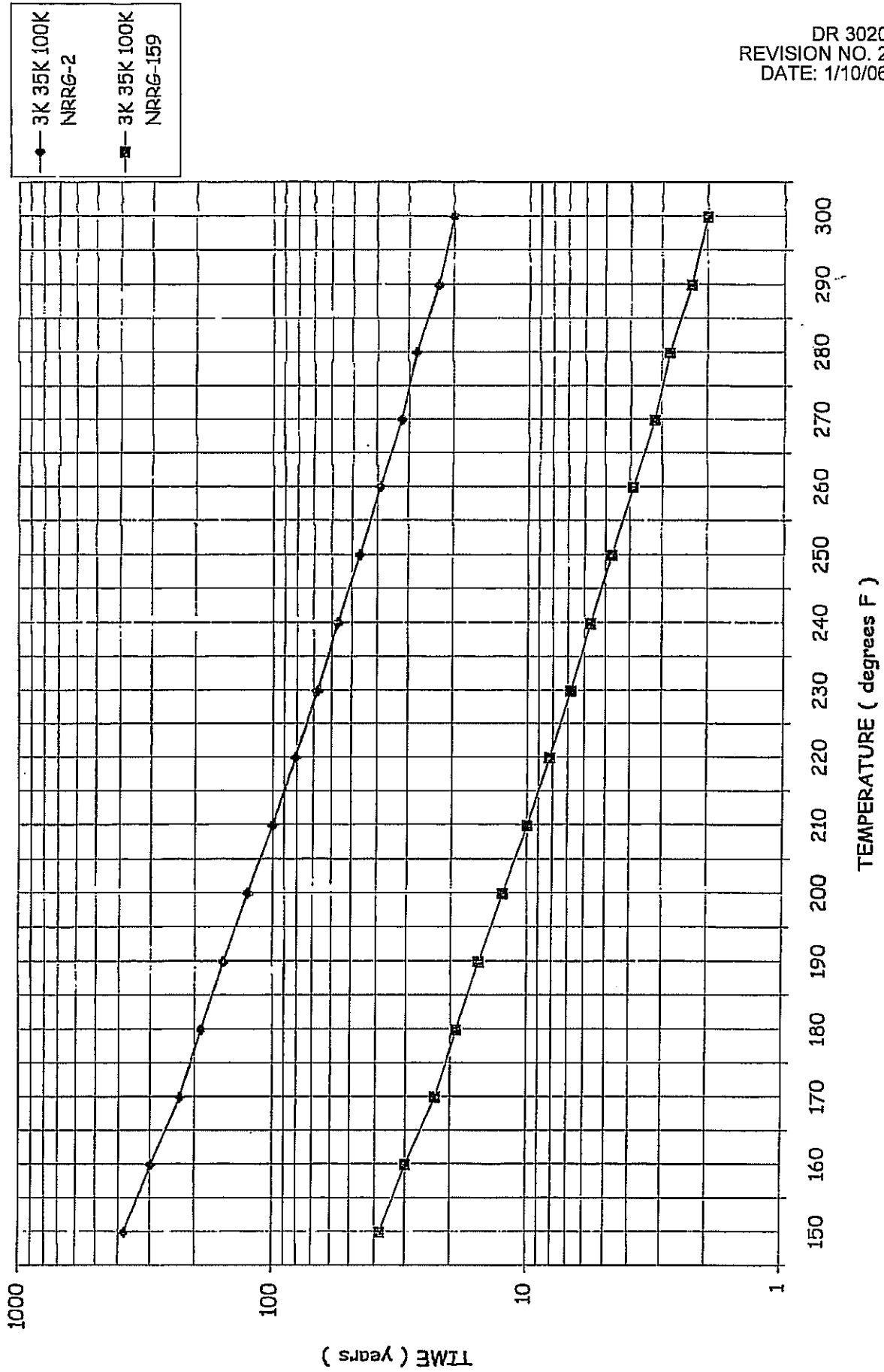


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PSA 3 PSA 35 PSA 100 NRRG-2 NRRG-159

TIME VS TEMPERATURE



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