3/4.4.6 PRESSURE/TEMPERATURE LIMITS

REACTOR COOLANT SYSTEM

LIMITING CONDITION FOR OPERATION

3.4.6.1 The reactor coolant system temperature and pressure shall be limited in accordance with the limit lines shown on (1) Figure 3.4.6.1-1 for heatup by non-nuclear means, cooldown following a nuclear shutdown, and low power PHYSICS TEST; (2) Figure 3.4.6.1-2 for operations with a critical core other than low power PHYSICS TESTS or when the reactor vessel is vented; and (3) Figures 3.4.6.1-3a or 3.4.6.1-3b, as applicable for inservice hydrostatic or leak testing, with:

a. A maximum heatup of 100°F in any one-hour period, except for inservice hydrostatic or leak testing at which time the maximum heatup shall not exceed 30°F in any one-hour period.

b. A maximum cooldown of 100°F in any one-hour period except for inservice hydrostatic or leak testing at which time maximum cooldown shall not exceed 30°F in any one-hour period.

c. A maximum temperature change limited to 10°F in any one-hour period during inservice hydrostatic and leak testing operations above the heatup and cooldown limit curves, and

d. The reactor vessel flange and head flange temperatures greater than or equal to 70°F when reactor vessel head bolting studs are under tension.

APPLICABILITY: At all times.

ACTION:

With any of the above limits exceeded, restore the temperature and/or pressure to within the limits within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the fracture toughness properties of the reactor coolant system; determine that the system remains acceptable for continued operations, or be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the next 24 hours.

SURVEILLANCE REQUIREMENTS

4.4.6.1.1 The reactor coolant system temperature and pressure shall be determined to be within the limits at least once per 30 minutes during system heatup, cooldown, and inservice leak and hydrostatic testing operations.

SURVEILLANCE REQUIREMENTS (Continued)

4.4.6.1.2 The reactor coolant system temperature and pressure shall be determined to be to the right of the criticality limit line of Figure 3.4.6.1-2 within 15 minutes prior to the withdrawal of control rods to bring the reactor to criticality.

4.4.6.1.3 The reactor material irradiation surveillance specimens shall be removed and examined to determine changes in material properties at the intervals shown in Table 4.4.6.1.3-1. The results of these examinations shall be used to update Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b, as applicable. The cumulative effective full power years shall be determined at least once per 18 months.

FIGURE 3.4.6.1-1
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

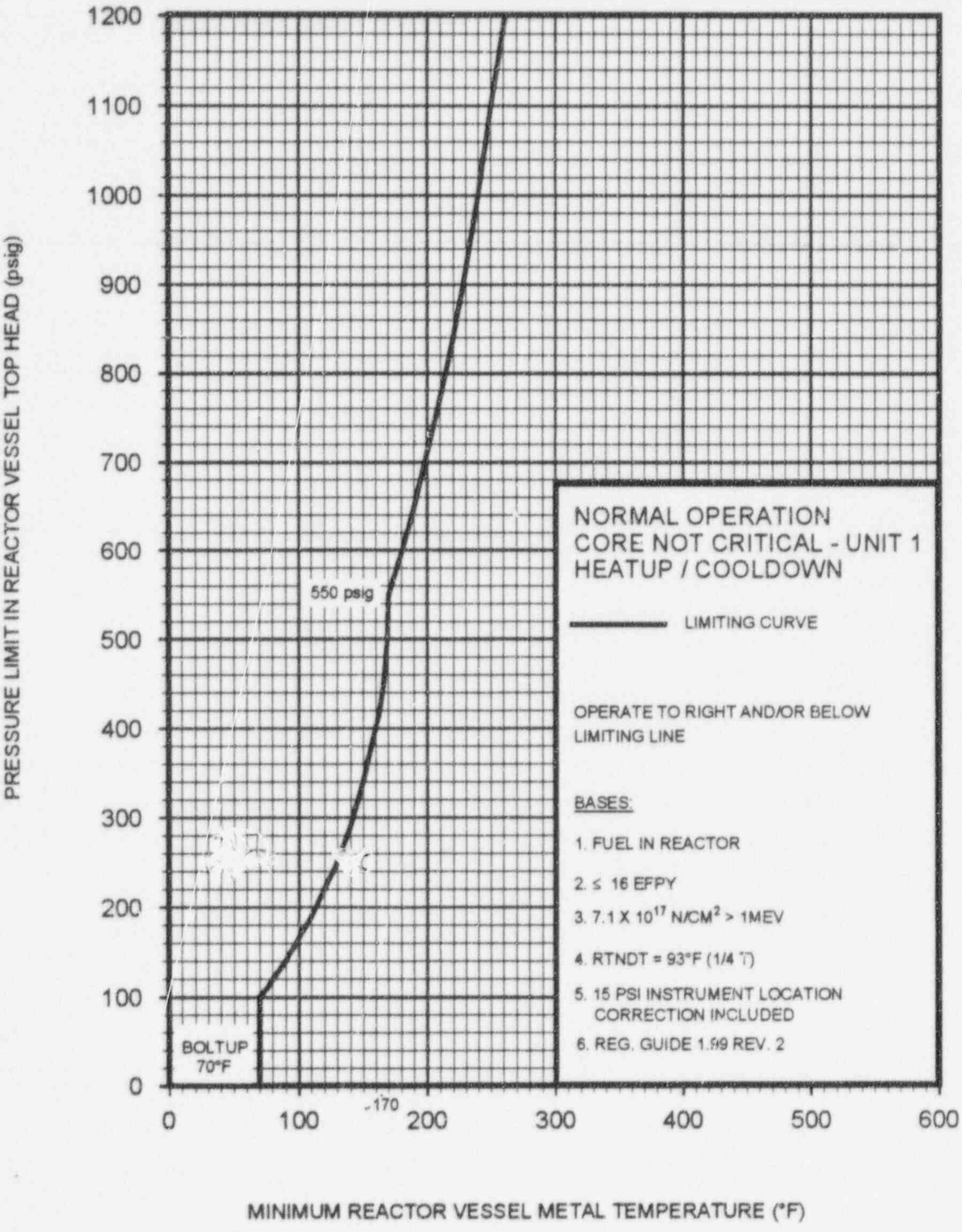


FIGURE 3.4.6.1-2
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

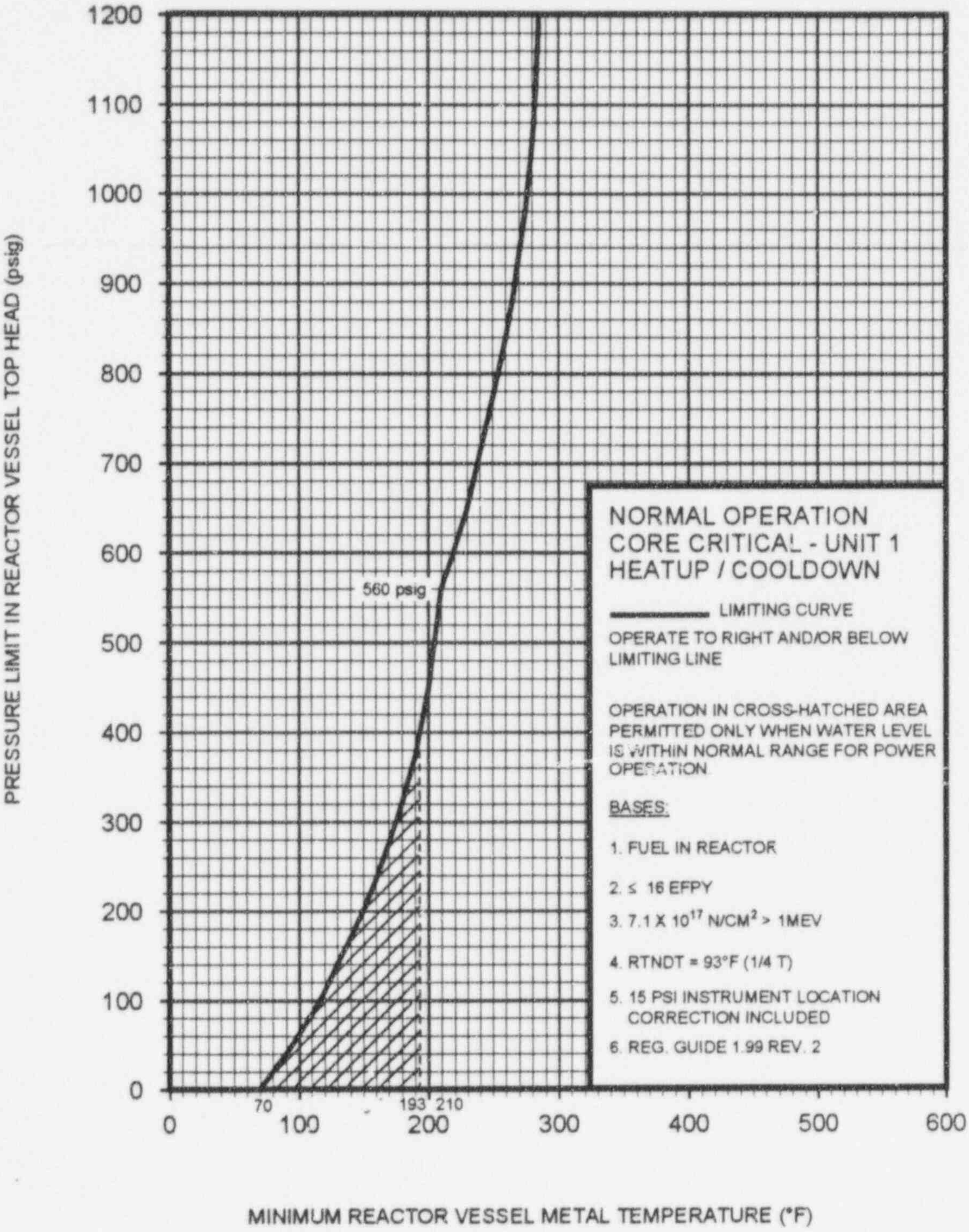


FIGURE 3.4.6.1-3a
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

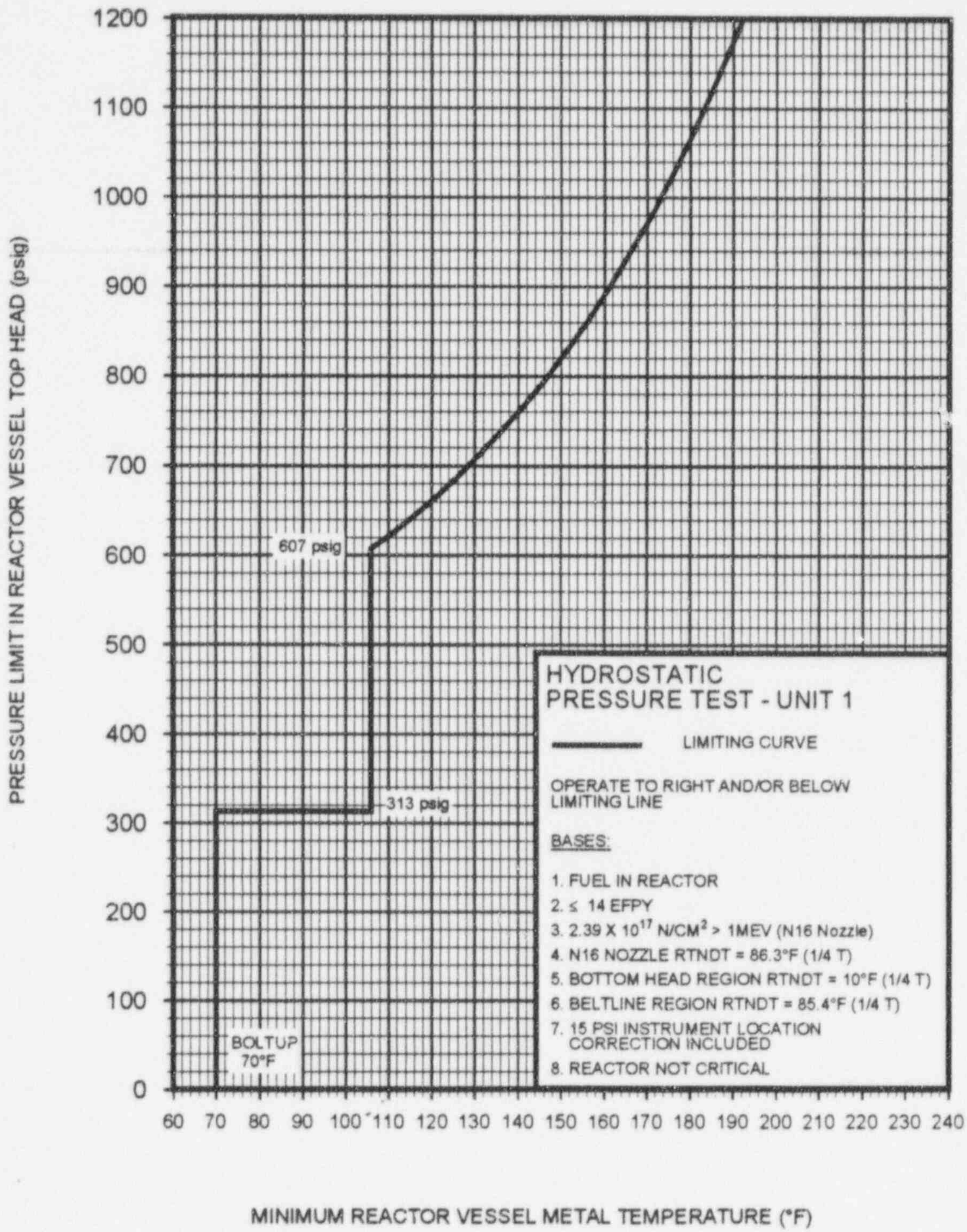
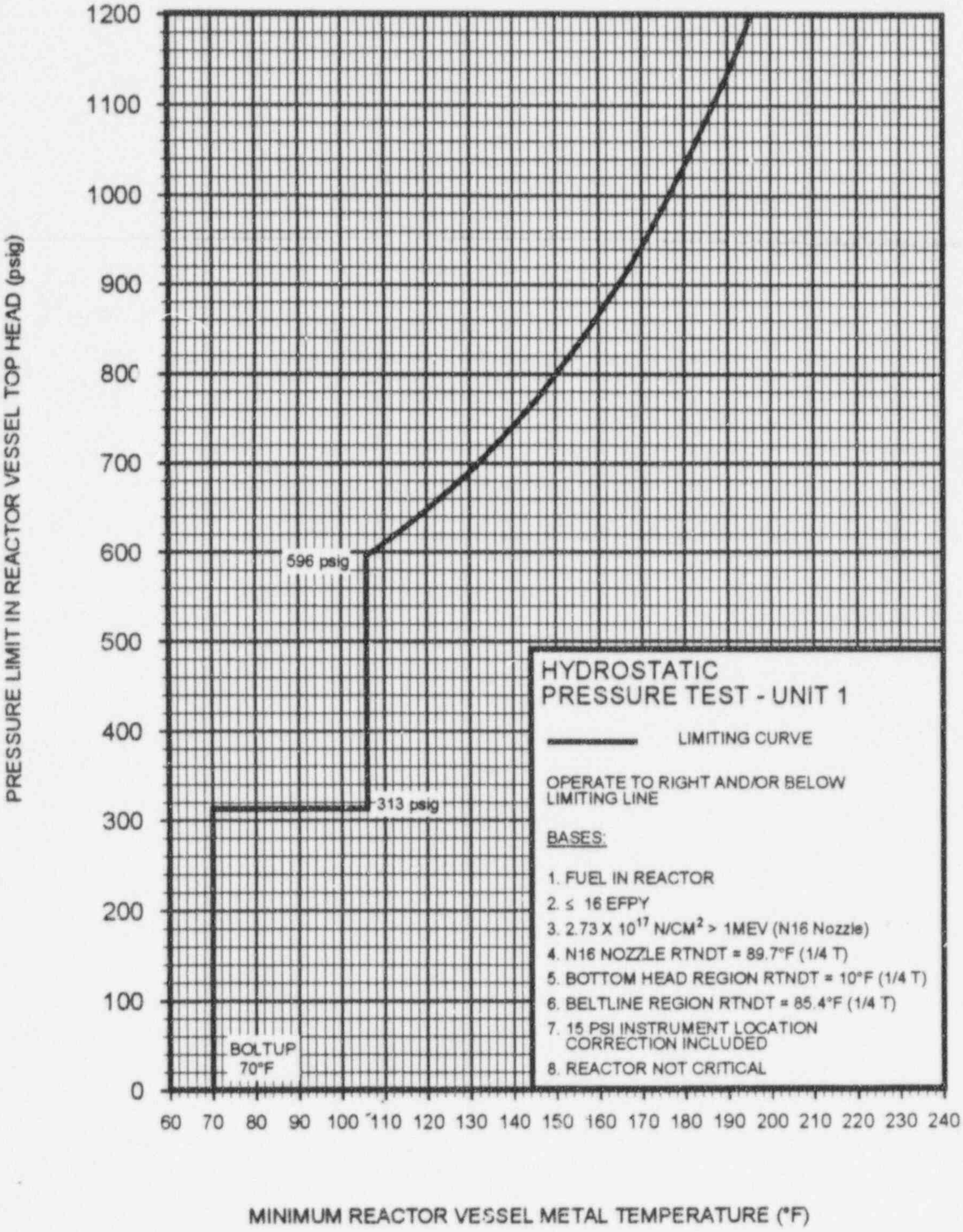


FIGURE 3.4.6.1-3b
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL



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PRESSURE/TEMPERATURE LIMITS (Continued)

start-up and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

During heatup, the thermal gradients in the reactor vessel wall produce thermal stresses which vary from compressive at the inner wall to tensile at the outer wall. Thermal-induced compressive stresses tend to alleviate the tensile stresses induced by the internal pressure. During cooldown, thermal gradients to be accounted for are tensile at the inner wall and compressive at the outer wall.

The reactor vessel materials have been tested to determine their initial RT_{NDT}. The results of these tests are shown in GE NEDO 24161, Revision 1. Reactor operation and resultant fast neutron, E>1 Mev, fluence will cause an increase in the RT_{NDT}. Therefore, an adjusted reference temperature, based upon the fluence, can be predicted using the proper revision of Regulatory Guide 1.99. The pressure-temperature limit curve Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b include predicted adjustments for this shift in RT_{NDT} at the end of indicated EFPY, as well as adjustments to account for the location of the pressure-sensing instruments.

The actual shift in RT_{NDT} of the vessel material will be checked periodically during operation by removing and evaluating, in accordance with ASTM E185-82, reactor vessel material irradiation surveillance specimens installed near the inside wall of the reactor vessel in the core area. Since the neutron spectra at the irradiation samples and vessel inside radius vary little, the measured transition shift for a sample can be adjusted with confidence to the adjacent section of the reactor vessel.

The pressure-temperature limit lines shown in Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b have been provided to assure compliance with the minimum temperature requirements of the 1983 revision to Appendix G of 10CFR50. The conservative method of the Standard Review Plan has been used for heatup and cooldown.

The number of reactor vessel irradiation surveillance specimens and the frequencies for removing and testing these specimens are provided in Table 4.4.6.1.3-1 to assure compliance with the requirements of ASTM E185-82.

ENCLOSURE 6

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1 AND 2
NRC DOCKETS 50-325 AND 50-324
OPERATING LICENSES DPR-71 AND DPR-62
REQUEST FOR LICENSE AMENDMENTS
PRESSURE-TEMPERATURE LIMITS CURVES

TYPED TECHNICAL SPECIFICATION AND BASES PAGES - UNIT 2

3/4.4.6 PRESSURE/TEMPERATURE LIMITS

REACTOR COOLANT SYSTEM

LIMITING CONDITION FOR OPERATION

3.4.6.1 The reactor coolant system temperature and pressure shall be limited in accordance with the limit lines shown on (1) Figure 3.4.6.1-1 for heatup by non-nuclear means, cooldown following a nuclear shutdown, and low power PHYSICS TEST; (2) Figure 3.4.6.1-2 for operations with a critical core other than low power PHYSICS TESTS or when the reactor vessel is vented; and (3) Figures 3.4.6.1-3a or 3.4.6.1-3b, as applicable for inservice hydrostatic or leak testing, with:

a. A maximum heatup of 100°F in any one-hour period, except for inservice hydrostatic or leak testing at which time the maximum heatup shall not exceed 30°F in any one-hour period.

b. A maximum cooldown of 100°F in any one-hour period except for inservice hydrostatic or leak testing at which time maximum cooldown shall not exceed 30°F in any one-hour period.

c. A maximum temperature change limited to 10°F in any one-hour period during inservice hydrostatic and leak testing operations above the heatup and cooldown limit curves, and

d. The reactor vessel flange and head flange temperatures greater than or equal to 70°F when reactor vessel head bolting studs are under tension.

APPLICABILITY: At all times.

ACTION:

With any of the above limits exceeded, restore the temperature and/or pressure to within the limits within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the fracture toughness properties of the reactor coolant system; determine that the system remains acceptable for continued operations, or be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the next 24 hours.

SURVEILLANCE REQUIREMENTS

4.4.6.1.1 The reactor coolant system temperature and pressure shall be determined to be within the limits at least once per 30 minutes during system heatup, cooldown, and inservice leak and hydrostatic testing operations.

SURVEILLANCE REQUIREMENTS (Continued)

4.4.6.1.2 The reactor coolant system temperature and pressure shall be determined to be to the right of the criticality limit line of Figure 3.4.6.1-2 within 15 minutes prior to the withdrawal of control rods to bring the reactor to criticality.

4.4.6.1.3 The reactor material irradiation surveillance specimens shall be removed and examined to determine changes in material properties at the intervals shown in Table 4.4.6.1.3-1. The results of these examinations shall be used to update Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b, as applicable. The cumulative effective full power years shall be determined at least once per 18 months.

FIGURE 3.4.6.1-1
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

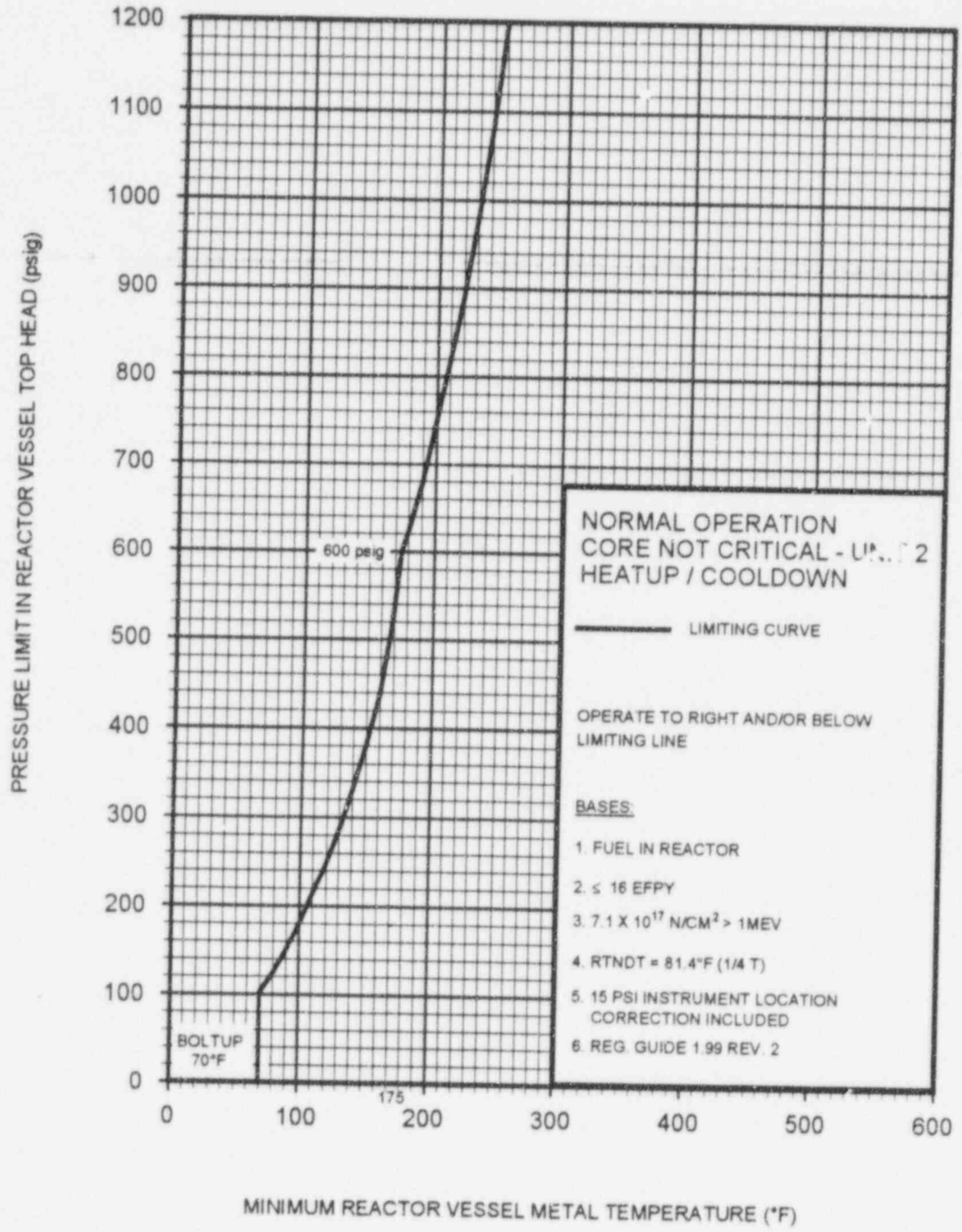


FIGURE 3.4.6.1-2
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

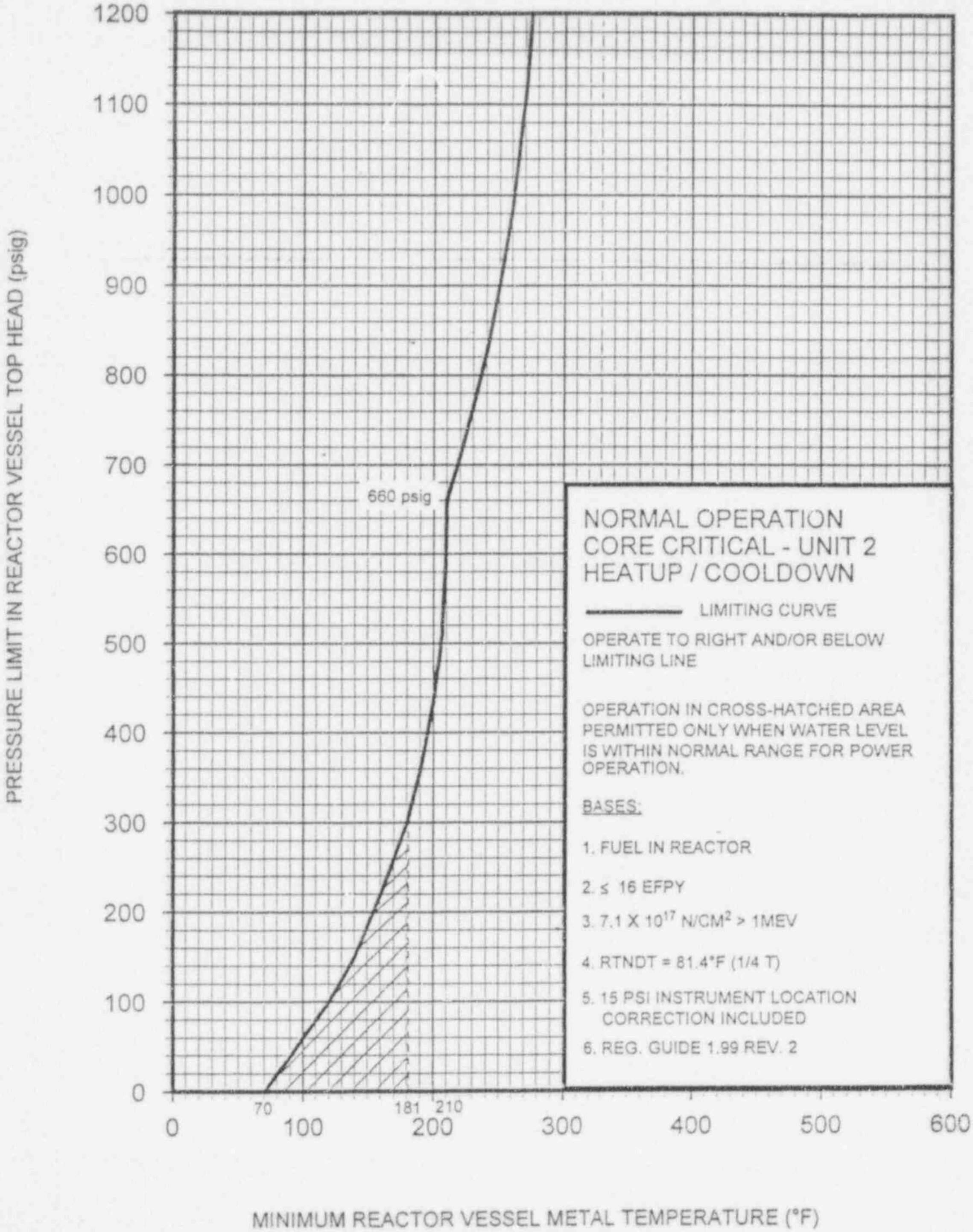


FIGURE 3.4.6.1-3a
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

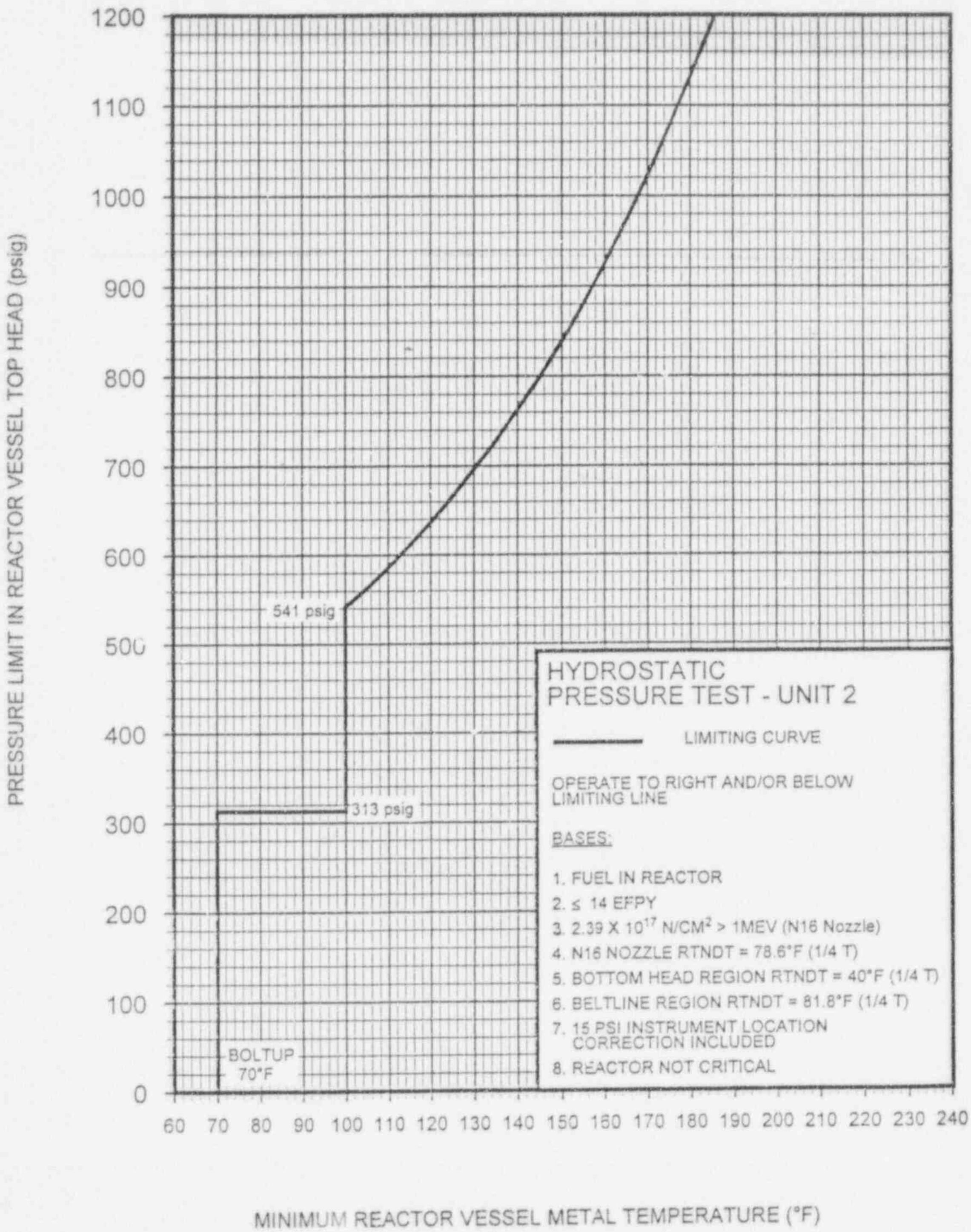
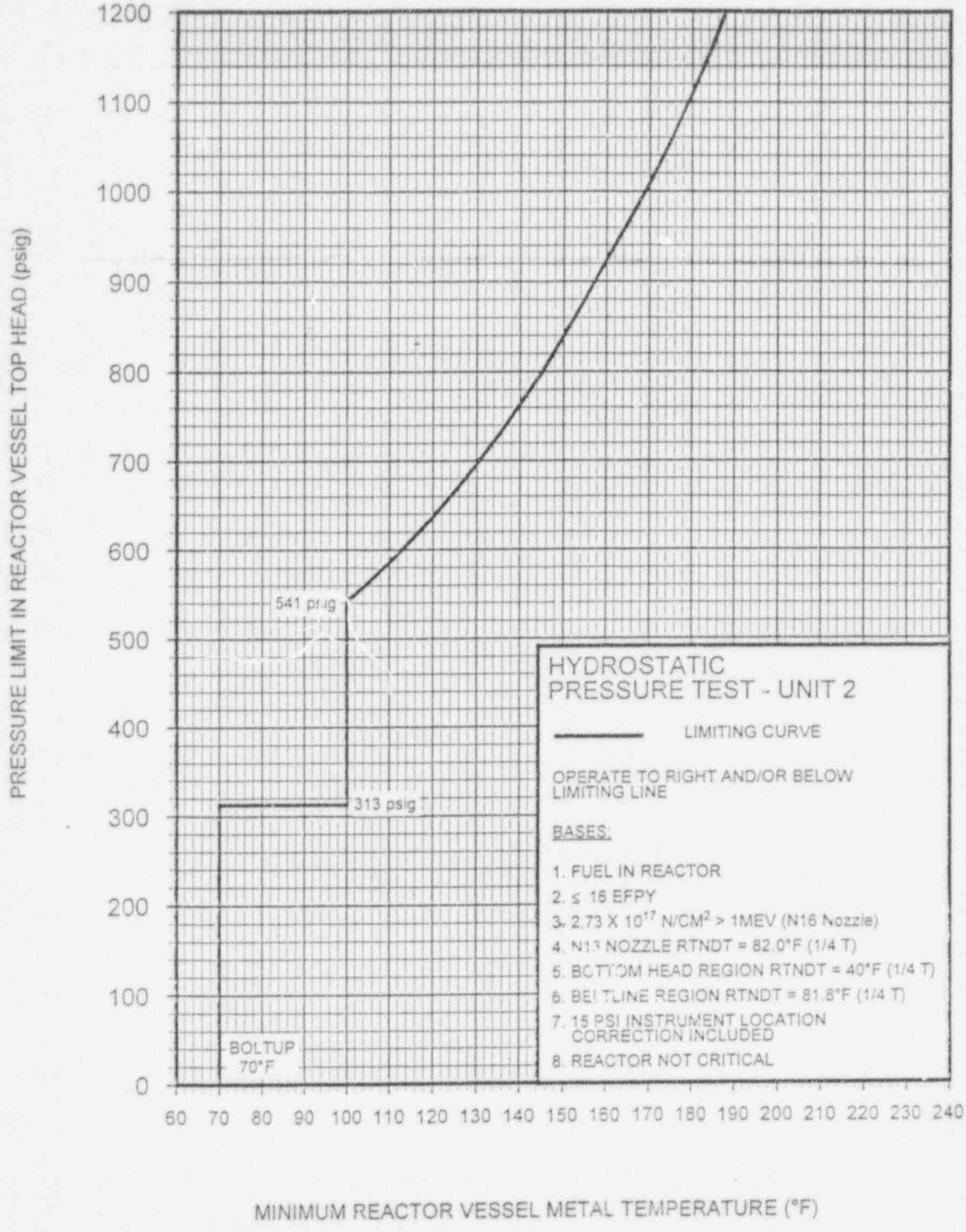


FIGURE 3.4.6.1-3b
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL



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PRESSURE/TEMPERATURE LIMITS (Continued)

start-up and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

During heatup, the thermal gradients in the reactor vessel wall produce thermal stresses which vary from compressive at the inner wall to tensile at the outer wall. Thermally induced compressive stresses tend to alleviate the tensile stresses induced by the internal pressure. During cooldown, thermal gradients to be accounted for are tensile at the inner wall and compressive at the outer wall.

The reactor vessel materials have been tested to determine their initial RT_{NDT}. The results of these tests are shown in GE NEDO-24157, Revision 2. Reactor operation and resultant fast neutron, E>1 Mev, fluence will cause an increase in the RT_{NDT}. Therefore, an adjusted reference temperature, based upon the fluence, can be predicted using the proper revision of Regulatory Guide 1.99. The pressure/temperature limit curves Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b include predicted adjustments for this shift in RT_{NDT} at the end of indicated EFPY, as well as adjustments to account for the location of the pressure-sensing instruments.

The actual shift in RT_{NDT} of the vessel material will be checked periodically during operation by removing and evaluating, in accordance with ASTM E185-82, reactor vessel material irradiation surveillance specimens installed near the inside wall of the reactor vessel in the core area. Since the neutron spectra at the irradiation samples and vessel inside radius vary little, the measured transition shift for a sample can be adjusted with confidence to the adjacent section of the reactor vessel.

The pressure/temperature limit lines shown in Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b have been provided to assure compliance with the minimum temperature requirements of the 1983 revision to Appendix G of 10CFR50. The conservative method of the Standard Review Plan has been used for heatup and cooldown.

The number of reactor vessel irradiation surveillance specimens and the frequencies for removing and testing these specimens are provided in Table 4.4.6.1.3-1 to assure compliance with the requirements of ASTM E185-82.

ENCLOSURE 7

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1 AND 2
NRC DOCKETS 50-325 AND 50-324
OPERATING LICENSES DPR-71 AND DPR-62
REQUEST FOR LICENSE AMENDMENTS
PRESSURE-TEMPERATURE LIMITS CURVES

MARKED-UP TECHNICAL SPECIFICATION AND BASES PAGES - UNIT 1

ENCLOSURE 7

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1 AND 2
NRC DOCKETS 50-325 AND 50-324
OPERATING LICENSES DPR-71 AND DPR-62
REQUEST FOR LICENSE AMENDMENTS
PRESSURE-TEMPERATURE LIMITS CURVES

MARKED-UP TECHNICAL SPECIFICATION AND BASES PAGES - UNIT 1

3/4.4.6 PRESSURE/TEMPERATURE LIMITS

REACTOR COOLANT SYSTEM

LIMITING CONDITION FOR OPERATION

3.4.6.1 The reactor coolant system temperature and pressure shall be limited in accordance with the limit lines shown on (1) Figure 3.4.6.1-1 for heatup by non-nuclear means, cooldown following a nuclear shutdown, and low power PHYSICS TESTS; (2) Figure 3.4.6.1-2 for operations with a critical core other than low power PHYSICS TESTS or when the reactor vessel is vented; and (3) Figures 3.4.6.1-3a, 3.4.6.1-3b, ~~or 3.4.6.1-3c,~~ as applicable for inservice hydrostatic or leak testing, with:

a. A maximum heatup of 100°F in any one-hour period, except for inservice hydrostatic or leak testing at which time the maximum heatup shall not exceed 30°F in any one-hour period.

b. A maximum cooldown of 100°F in any one-hour period except for inservice hydrostatic or leak testing at which time maximum cooldown shall not exceed 30°F in any one-hour period.

c. A maximum temperature change limited to 10°F in any one-hour period during inservice hydrostatic and leak testing operations above the heatup and cooldown limit curves, and

d. The reactor vessel flange and head flange temperatures greater than or equal to 70°F when reactor vessel head bolting studs are under tension.

APPLICABILITY: At all times.

ACTION:

With any of the above limits exceeded, restore the temperature and/or pressure to within the limits within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the fracture toughness properties of the reactor coolant system; determine that the system remains acceptable for continued operations, or be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the next 24 hours.

SURVEILLANCE REQUIREMENTS

4.4.6.1.1 The reactor coolant system temperature and pressure shall be determined to be within the limits at least once per 30 minutes during system heatup, cooldown, and inservice leak and hydrostatic testing operations.

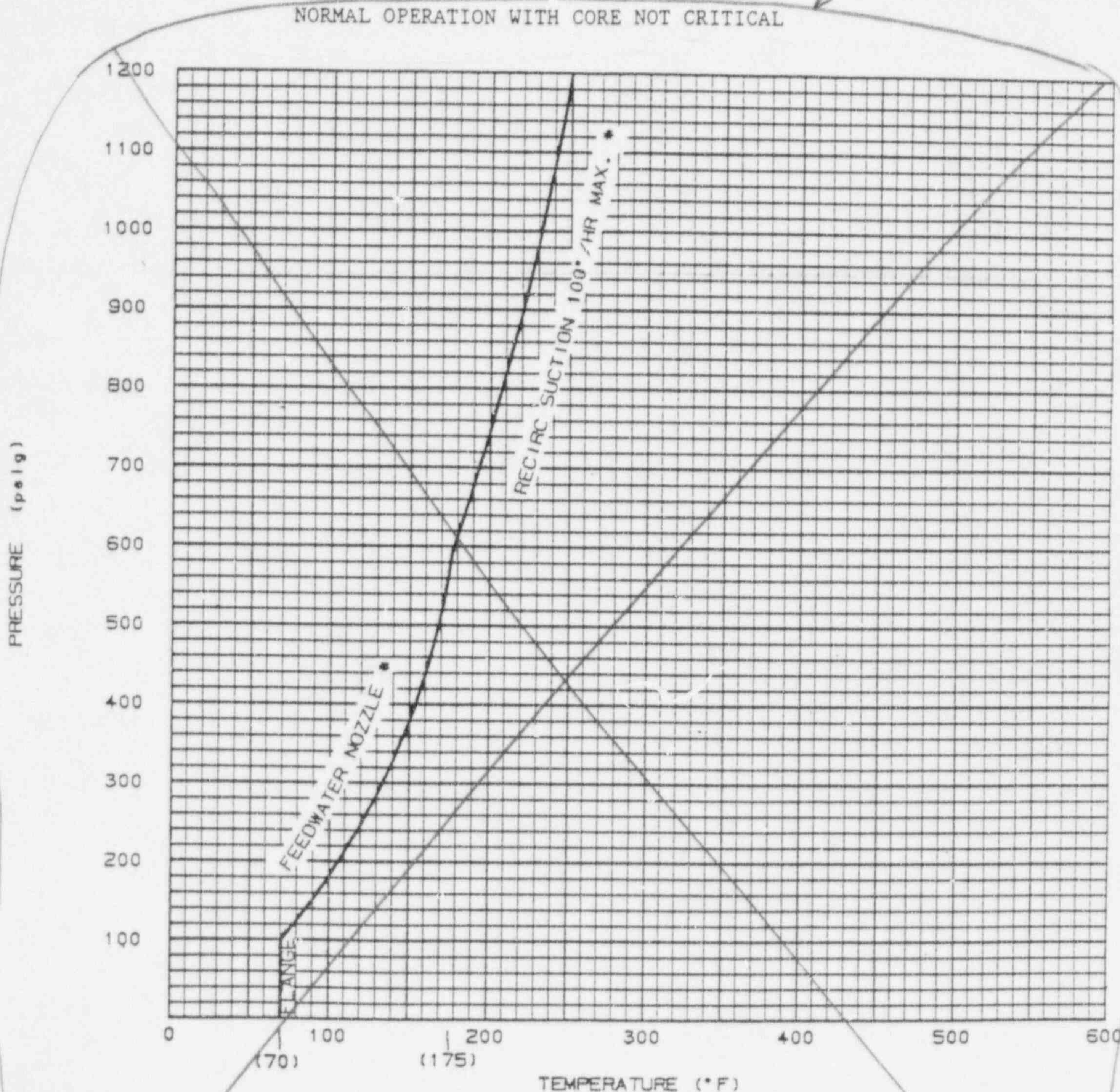
SURVEILLANCE REQUIREMENTS (Continued)

4.4.6.1.2 The reactor coolant system temperature and pressure shall be determined to be to the right of the criticality limit line of Figure 3.4.6.1-2 within 15 minutes prior to the withdrawal of control rods to bring the reactor to criticality.

4.4.6.1.3 The reactor material irradiation surveillance specimens shall be removed and examined to determine changes in material properties at the intervals shown in Table 4.4.6.1.3-1. The results of these examinations shall be used to update Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b, ~~and 3.4.6.1-3c,~~ as applicable. The cumulative effective full power years shall be determined at least once per 18 months.

FIGURE 3.4.6.1-1
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

Insert 3.4.6.1-1



BASES:

1. FUEL IN REACTOR
2. ≤ 16 EFPY
3. 7.1 X 10^{17} N/CM^2 > 1 MEV
4. RT_{NDT} = 81.4° (1/4 T)
5. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED
6. REG. GUIDE 1.99 REV. 2

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES

PRESSURE/TEMPERATURE LIMITS (Continued)

start-up and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

During heatup, the thermal gradients in the reactor vessel wall produce thermal stresses which vary from compressive at the inner wall to tensile at the outer wall. Thermal-induced compressive stresses tend to alleviate the tensile stresses induced by the internal pressure. During cooldown, thermal gradients to be accounted for are tensile at the inner wall and compressive at the outer wall.

The reactor vessel materials have been tested to determine their initial RT_{NDT}. The results of these tests are shown in GE NEDO 24161, Revision 1. Reactor operation and resultant fast neutron, E>1 Mev, fluence will cause an increase in the RT_{NDT}. Therefore, an adjusted reference temperature, based upon the fluence, can be predicted using the proper revision of Regulatory Guide 1.99. The pressure-temperature limit curve Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b include predicted adjustments for this shift in RT_{NDT} at the end of indicated EFPY, as well as adjustments to account for the location of the pressure-sensing instruments.

The actual shift in RT_{NDT} of the vessel material will be checked periodically during operation by removing and evaluating, in accordance with ASTM E185-82, reactor vessel material irradiation surveillance specimens installed near the inside wall of the reactor vessel in the core area. Since the neutron spectra at the irradiation samples and vessel inside radius vary little, the measured transition shift for a sample can be adjusted with confidence to the adjacent section of the reactor vessel.

The pressure-temperature limit lines shown in Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, and 3.4.6.1-3b have been provided to assure compliance with the minimum temperature requirements of the 1983 revision to Appendix G of 10CFR50. The conservative method of the Standard Review Plan has been used for heatup and cooldown.

The number of reactor vessel irradiation surveillance specimens and the frequencies for removing and testing these specimens are provided in Table 4.4.6.1.3-1 to assure compliance with the requirements of ASTM E185-82.

Insert 3.4.6.1 - 1

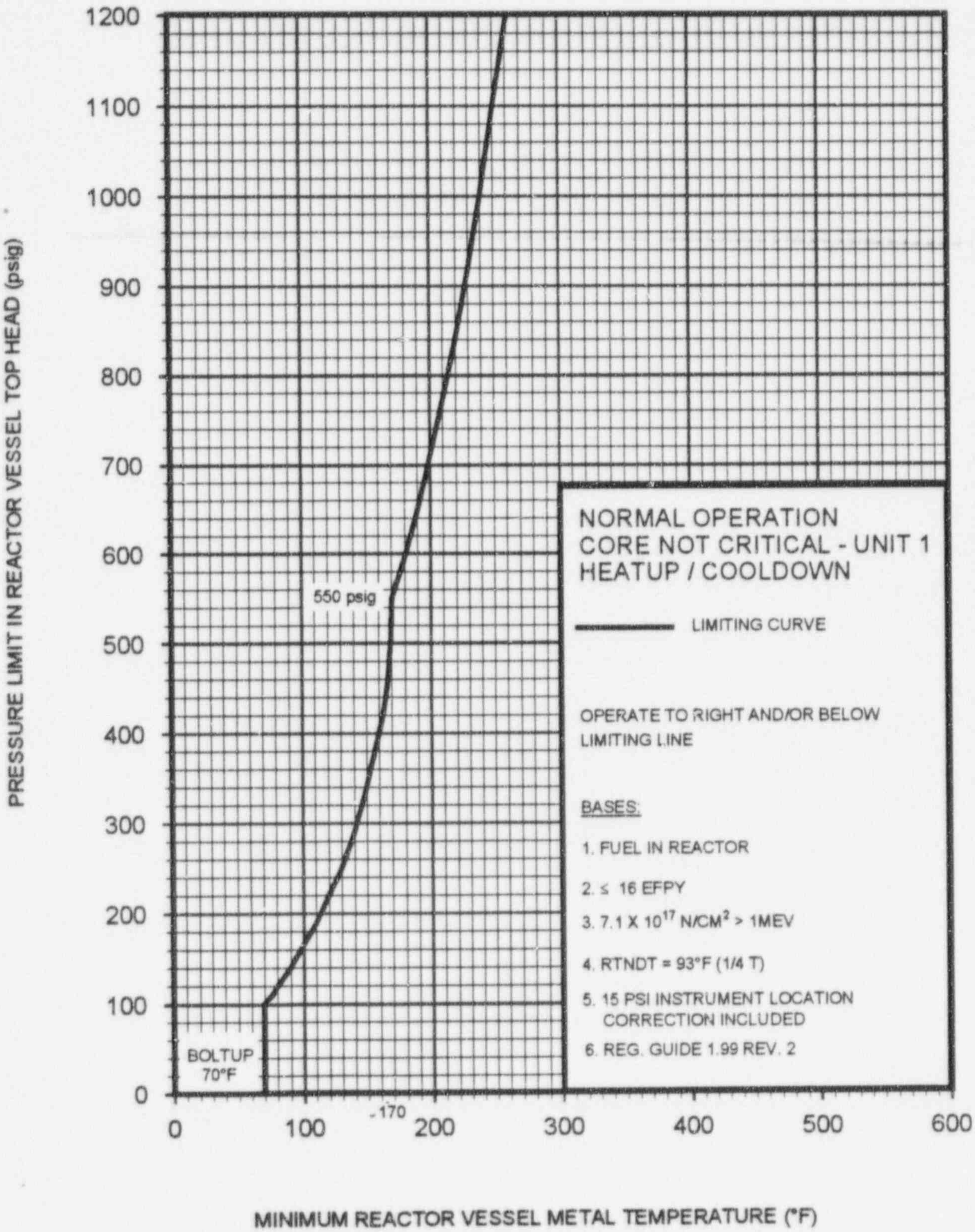
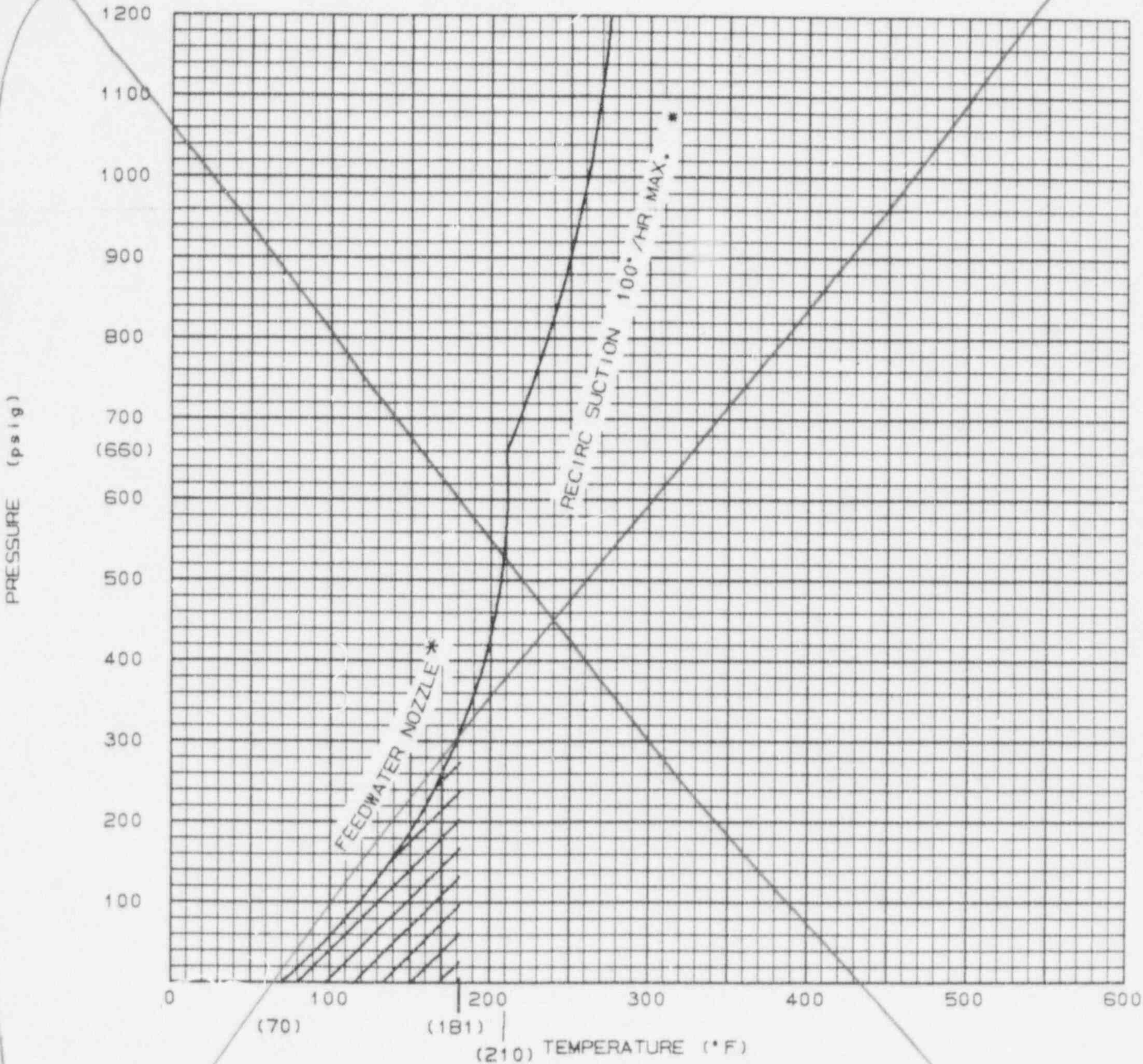


FIGURE 3.4.6.1-2
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

Insert 3.4.6.1-2

NORMAL OPERATION WITH CORE CRITICAL



BASES:

1. FUEL IN REACTOR
2. ≤ 16 EFPY
3. 7.1×10^{17} N/CM^2 > 1 MEV
4. RT_{NDT} = 81.4° (1/4 T)
5. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED
6. REG. GUIDE 1.99 REV. 2

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES
4. OPERATION IN CROSS-HATCHED AREA PERMITTED ONLY WHEN WATER LEVEL IS WITHIN NORMAL RANGE FOR POWER OPERATION.

Insert 3.4.6.1 - 2

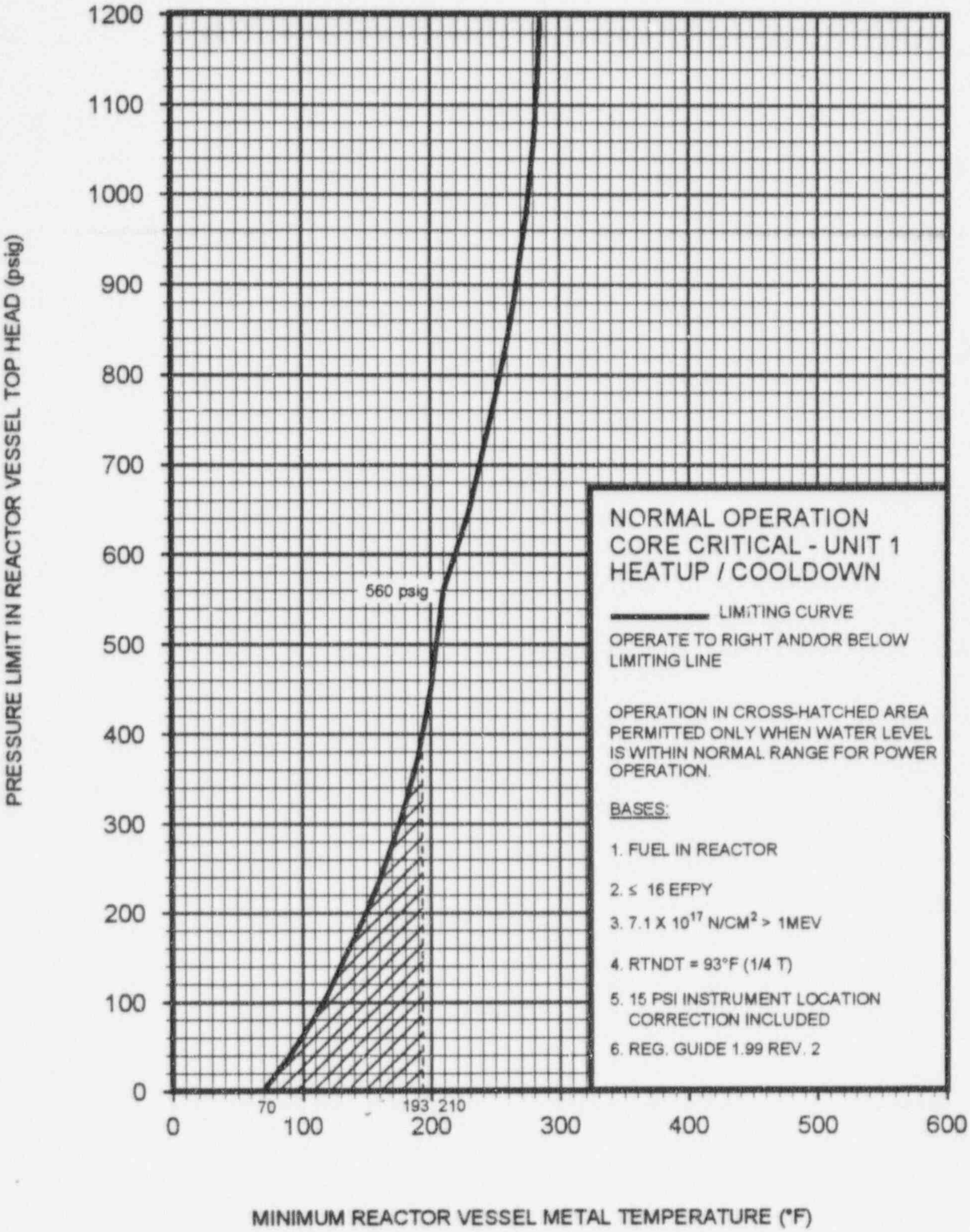
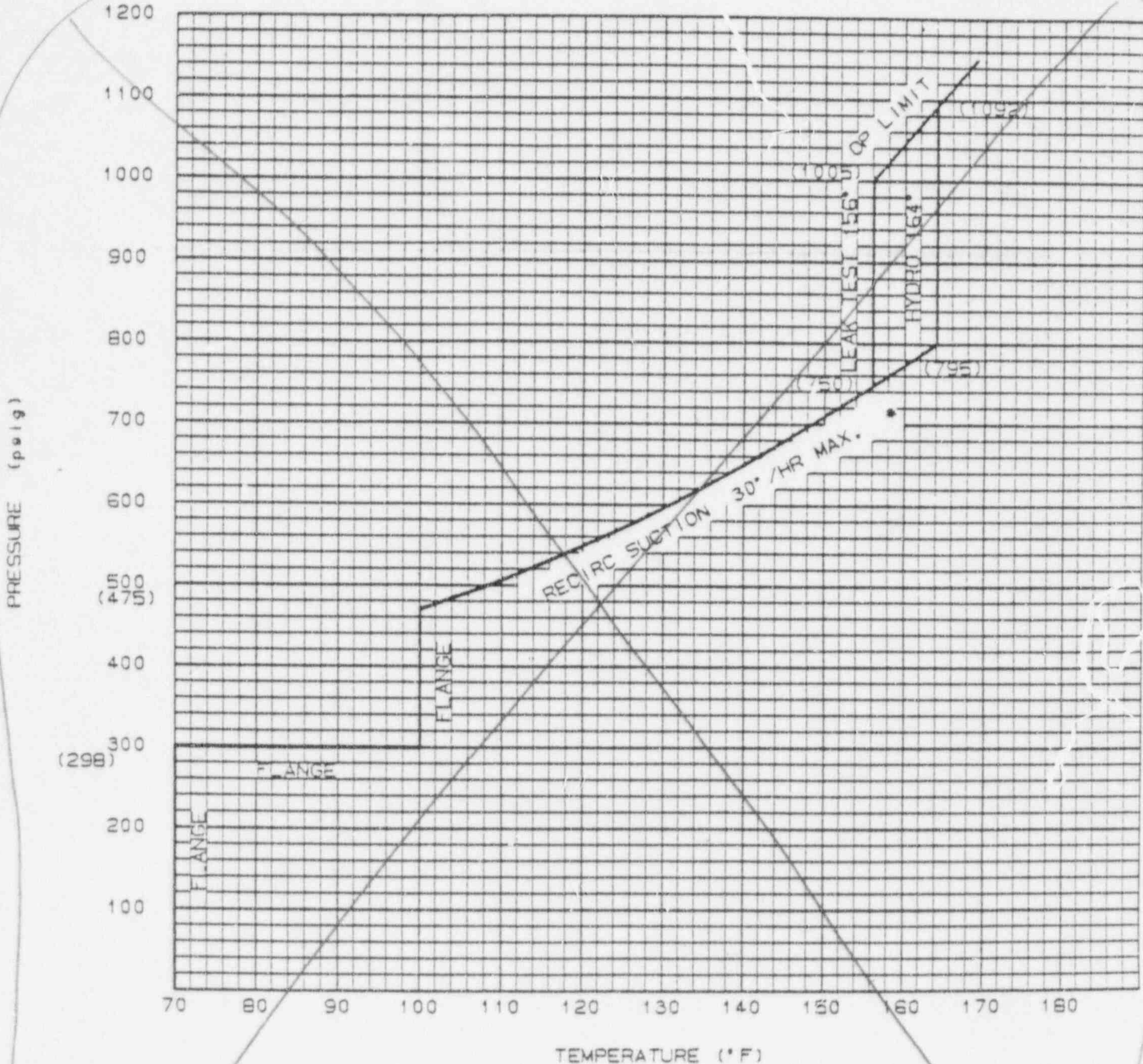


FIGURE 3.4.6.1-3a
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

Insert 3.4.6.1-3a

HYDROSTATIC AND LEAK TESTS



BASES:

1. FUEL IN REACTOR
2. REACTOR NOT CRITICAL
3. REG. GUIDE 1.99 REV. 2
4. ≤ 8 EFPY
5. 3.5×10^{17} N/CM^2 > 1 MEV
6. RT_{NDT} = 66° (1/4 T)
7. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES
4. OPERATING LIMIT INDICATES TEMPERATURE REQUIRED IF TEST PRESSURE WAS EXCEEDED.

Insert 3.4.6.1 - 3a

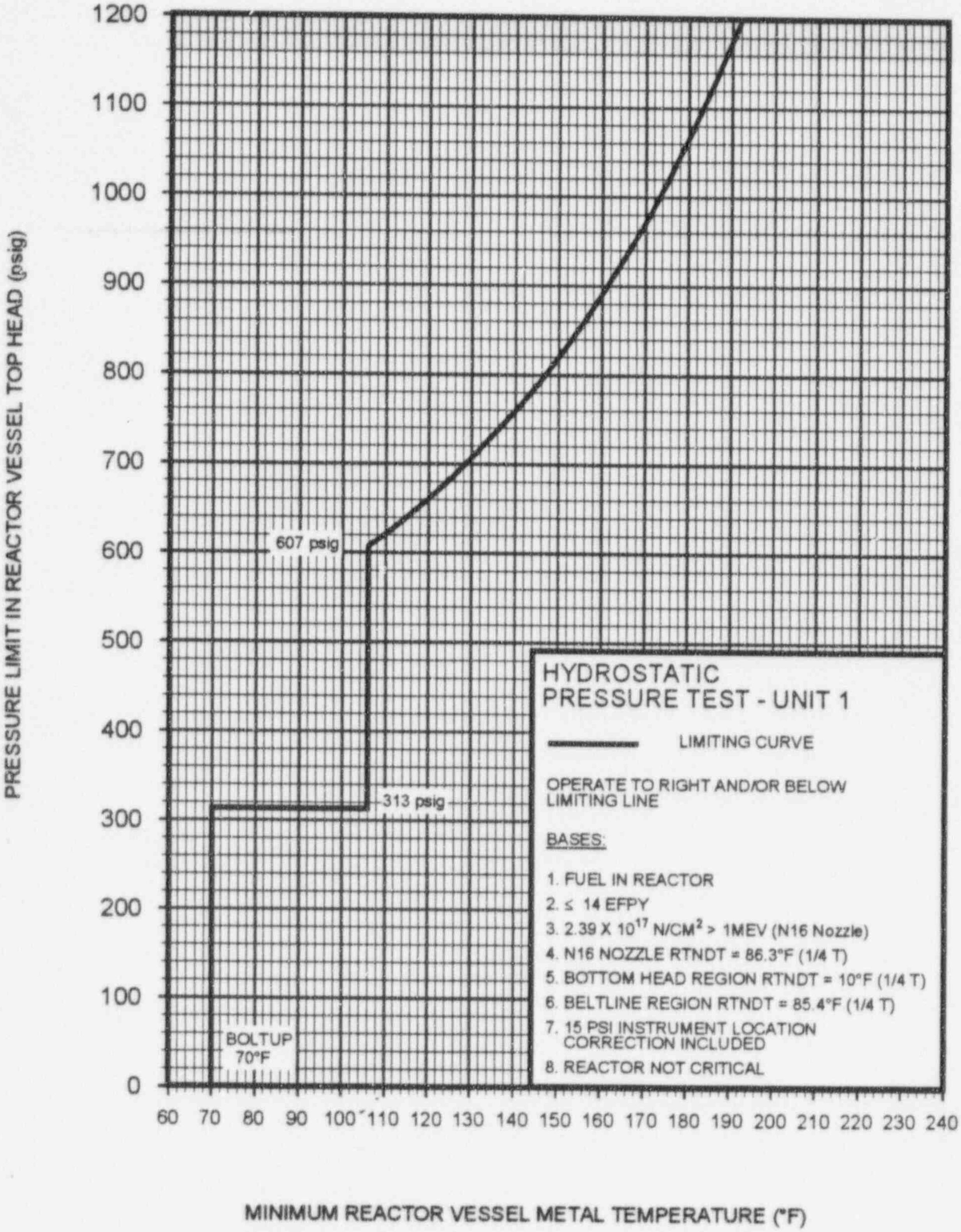
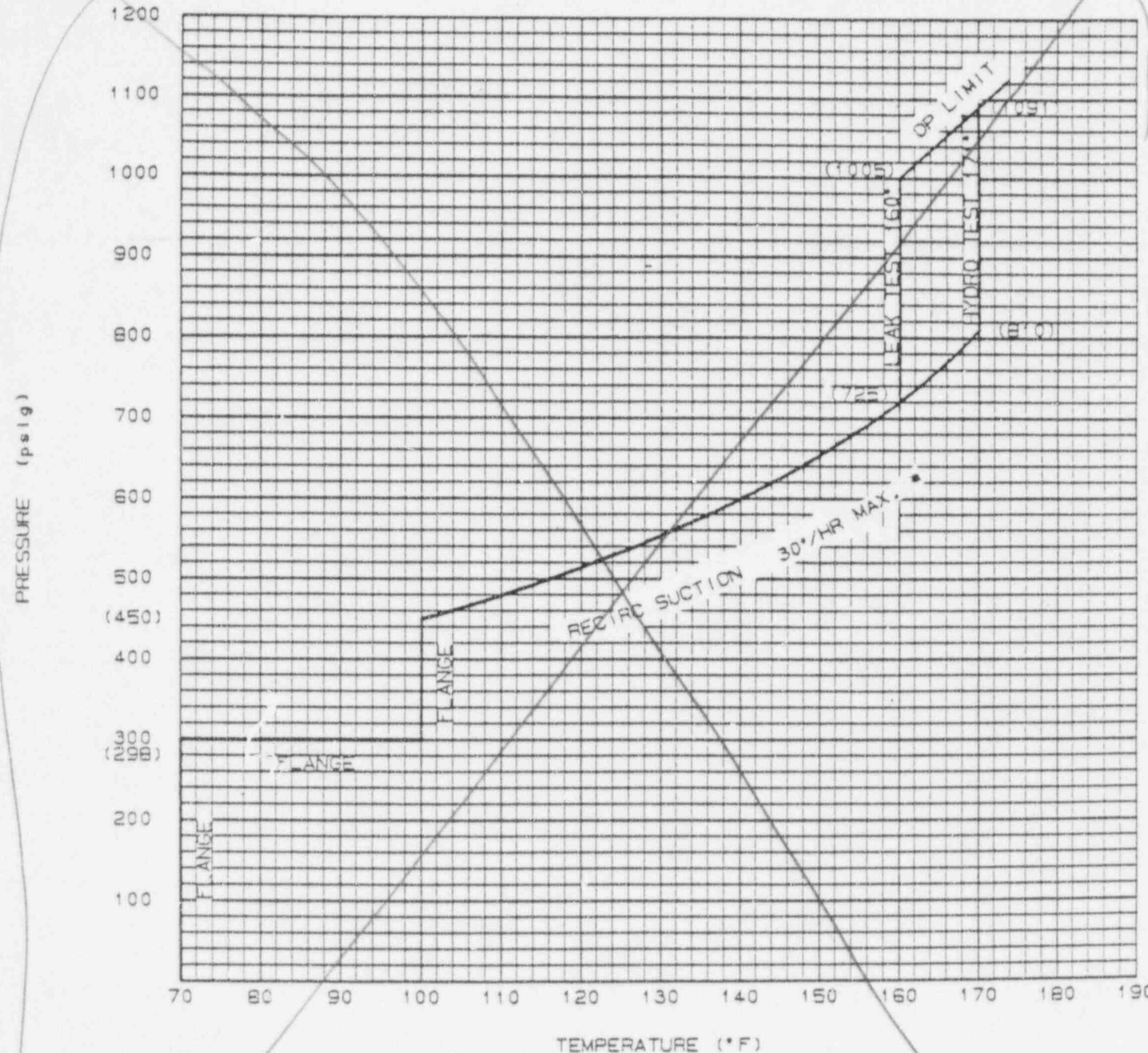


FIGURE 3.4.6.1-3b
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

Insert 3.4.6.1 - 3b

HYDROSTATIC AND LEAK TESTS



BASES:

1. FUEL IN REACTOR
2. $\leq$ 10 EFPY
3. 4.4×10^{17} N/CM^2 > 1 MEV
4. RT_{NDT} = 73° (1/4 T)
5. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED
6. REG. GUIDE 1.99 REV. 2
7. REACTOR NOT CRITICAL

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES
4. OPERATING LIMIT INDICATES TEMPERATURE REQUIRED IF TEST PRESSURE WAS EXCEEDED.

Insert 3.4.6.1-3b

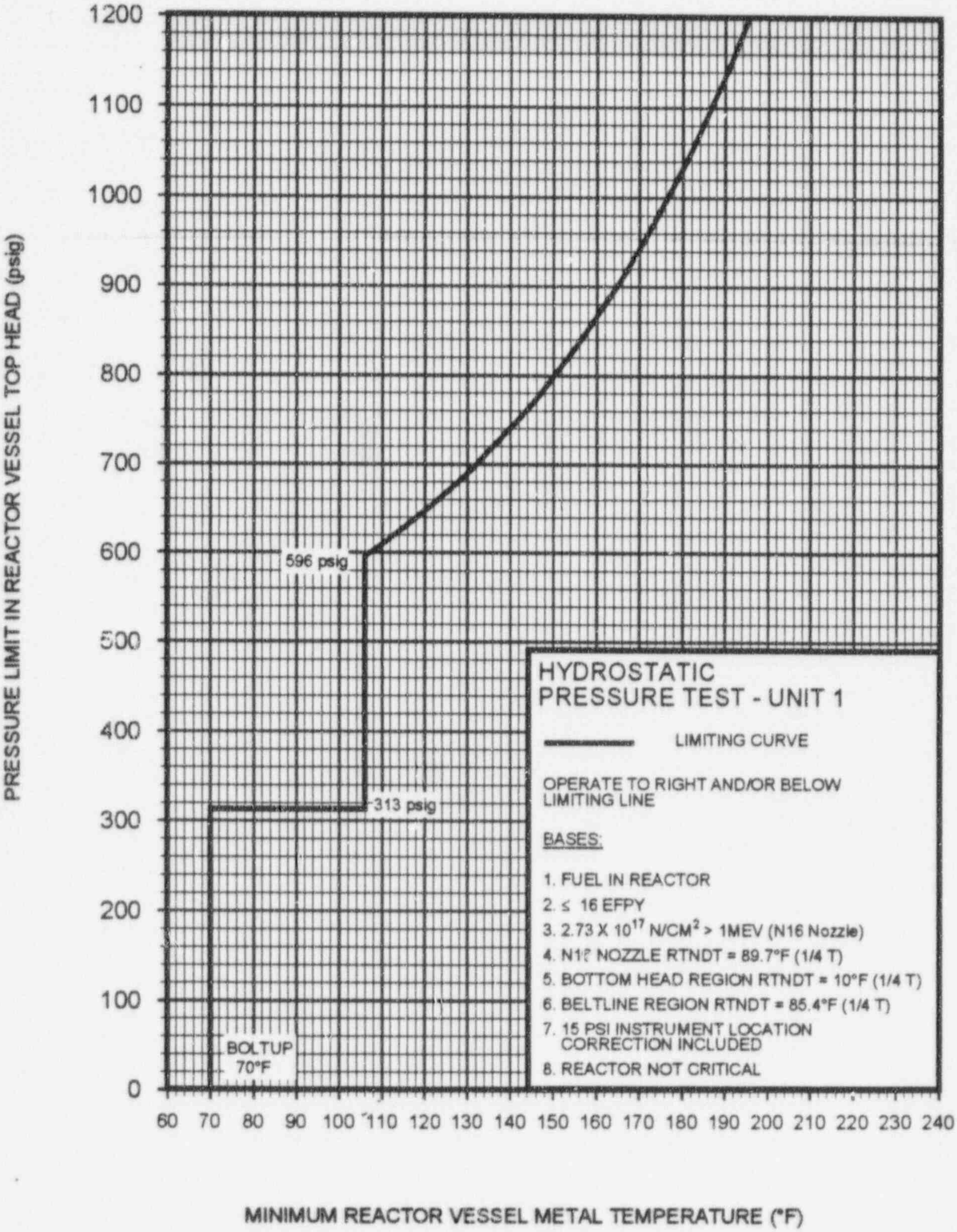


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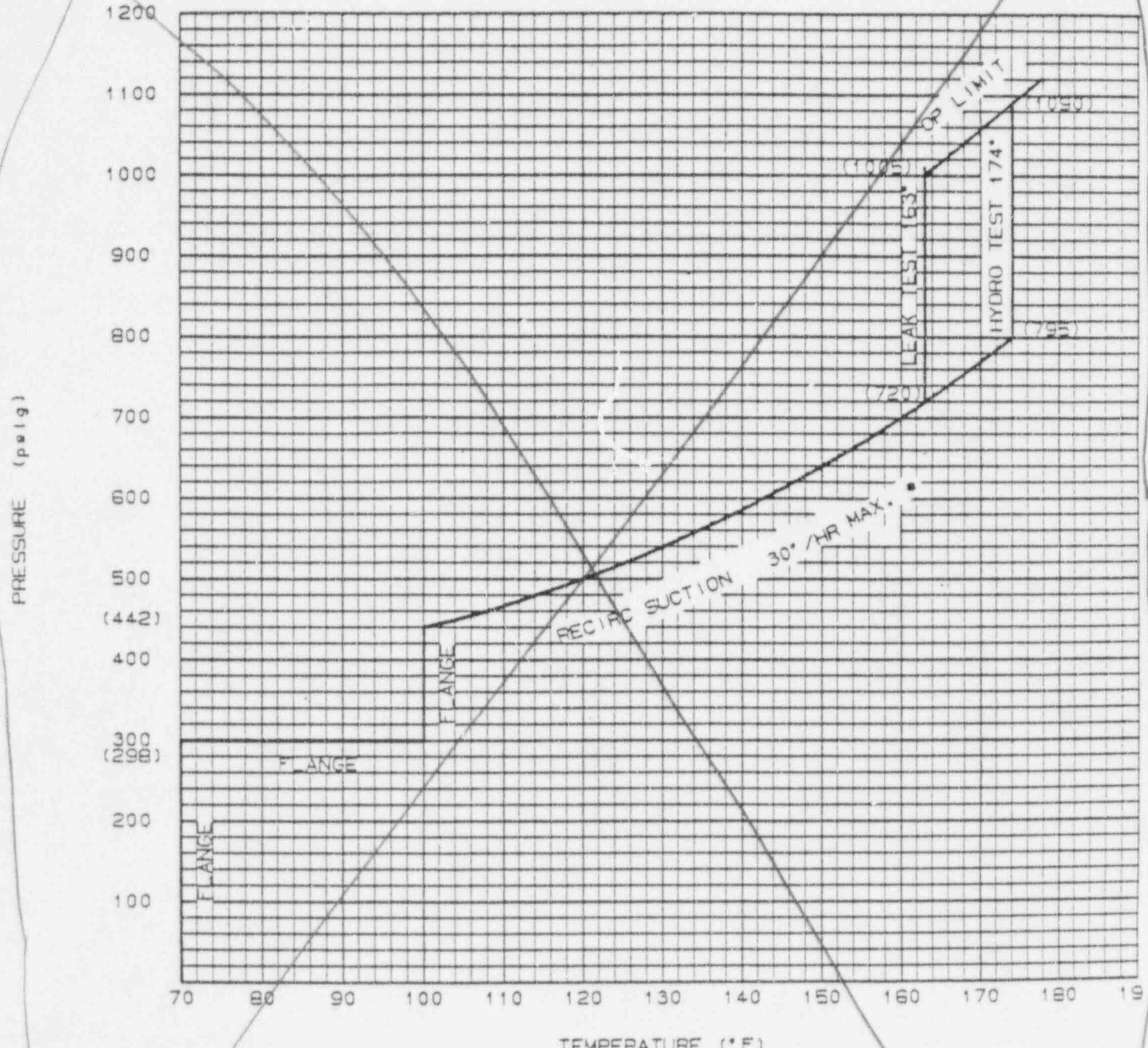
FIGURE 3.4.6.1-3c
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

HYDROSTATIC AND LEAK TESTS



BASES:
1. FUEL IN REACTOR
2. ≤ 12 EFPY
3. 5.3×10^{17} N/CM^2 > 1 MEV
4. RT_{NDT} = 76° (1/4 T)
5. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED
6. REG. GUIDE 1.99 REV. 2
7. REACTOR NOT CRITICAL

NOTES:
1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES
4. OPERATING LIMIT INDICATES TEMPERATURE REQUIRED IF TEST PRESSURE WAS EXCEEDED.

PRESSURE/TEMPERATURE LIMITS (Continued)

start-up and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

During heatup, the thermal gradients in the reactor vessel wall produce thermal stresses which vary from compressive at the inner wall to tensile at the outer wall. Thermal-induced compressive stresses tend to alleviate the tensile stresses induced by the internal pressure. During cooldown, thermal gradients to be accounted for are tensile at the inner wall and compressive at the outer wall.

The reactor vessel materials have been tested to determine their initial RT_{NDT}. The results of these tests are shown in GE NEDO 24161. Reactor operation and resultant fast neutron, E>1 Mev, fluence will cause an increase in the RT_{NDT}. Therefore, an adjusted reference temperature, based upon the fluence, can be predicted using the proper revision of Regulatory Guide 1.99. The pressure-temperature limit curve Figures 3.4.6.1-1, 3.4.6.1-2, and 3.4.6.1-3a, through 3.4.6.1-3c include predicted adjustments for this shift in RT_{NDT} at the end of indicated EFPY, as well as adjustments to account for the location of the pressure-sensing instruments.

The actual shift in RT_{NDT} of the vessel material will be checked periodically during operation by removing and evaluating, in accordance with ASTM E185-82, reactor vessel material irradiation surveillance specimens installed near the inside wall of the reactor vessel in the core area. Since the neutron spectra at the irradiation samples and vessel inside radius vary little, the measured transition shift for a sample can be adjusted with confidence to the adjacent section of the reactor vessel.

The pressure-temperature limit lines shown in Figures 3.4.6.1-1, 3.4.6.1-2 and 3.4.6.1-3a through 3.4.6.1-3c have been provided to assure compliance with the minimum temperature requirements of the 1983 revision to Appendix G of 10CFR50. The conservative method of the Standard Review Plan has been used for heatup and cooldown.

The number of reactor vessel irradiation surveillance specimens and the frequencies for removing and testing these specimens are provided in Table 4.4.6.1.3-1 to assure compliance with the requirements of ASTM E185-82.

ENCLOSURE 8

BRUNSWICK STEAM ELECTRIC PLANT, UNIT 1 AND 2
NRC DOCKETS 50-325 AND 50-324
OPERATING LICENSES DPR-71 AND DPR-62
REQUEST FOR LICENSE AMENDMENTS
PRESSURE-TEMPERATURE LIMITS CURVES

MARKED-UP TECHNICAL SPECIFICATION AND BASES PAGES - UNIT 2

3/4.4.6 PRESSURE/TEMPERATURE LIMITS

REACTOR COOLANT SYSTEM

LIMITING CONDITION FOR OPERATION

3.4.6.1 The reactor coolant system temperature and pressure shall be limited in accordance with the limit lines shown on (1) Figure 3.4.6.1-1 for heatup by non-nuclear means, cooldown following a nuclear shutdown, and low power PHYSICS TESTS; (2) Figure 3.4.6.1-2 for operations with a critical core other than low power PHYSICS TESTS or when the reactor vessel is vented; and (3) Figures 3.4.6.1-3a, 3.4.6.1-3b, ~~or 3.4.6.1-3c,~~ as applicable for inservice hydrostatic or leak testing, with:

a. A maximum heatup of 100°F in any one-hour period, except for inservice hydrostatic or leak testing at which time the maximum heatup shall not exceed 30°F in any one-hour period.

b. A maximum cooldown of 100°F in any one-hour period except for inservice hydrostatic or leak testing at which time maximum cooldown shall not exceed 30°F in any one-hour period.

c. A maximum temperature change limited to 10°F in any one-hour period during inservice hydrostatic and leak testing operations above the heatup and cooldown limit curves, and

d. The reactor vessel flange and head flange temperatures greater than or equal to 70°F when reactor vessel head bolting studs are under tension.

APPLICABILITY: At all times.

ACTION:

With any of the above limits exceeded, restore the temperature and/or pressure to within the limits within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the fracture toughness properties of the reactor coolant system; determine that the system remains acceptable for continued operations, or be in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the next 24 hours.

SURVEILLANCE REQUIREMENTS

4.4.6.1.1 The reactor coolant system temperature and pressure shall be determined to be within the limits at least once per 30 minutes during system heatup, cooldown, and inservice leak and hydrostatic testing operations.

SURVEILLANCE REQUIREMENTS (Continued)

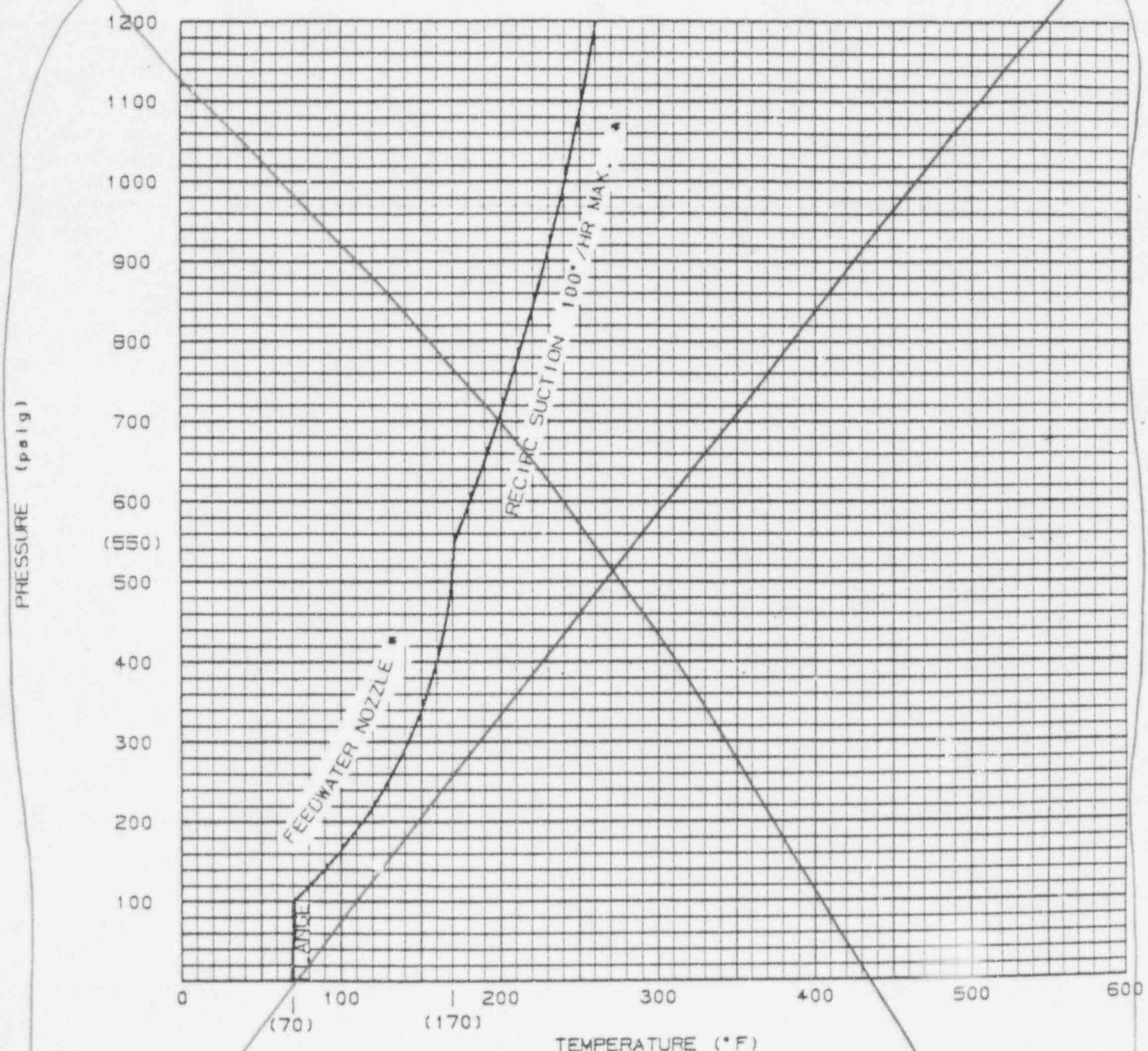
4.4.6.1.2 The reactor coolant system temperature and pressure shall be determined to be to the right of the criticality limit line of Figure 3.4.6.1-2 within 15 minutes prior to the withdrawal of control rods to bring the reactor to criticality.

4.4.6.1.3 The reactor material irradiation surveillance specimens shall be removed and examined to determine changes in material properties at the intervals shown in Table 4.4.6.1.3-1. The results of these examinations shall be used to update Figures 3.4.6.1-1, 3.4.6.1-2, 3.4.6.1-3a, 3.4.6.1-3b, and 3.4.6.1-3c, as applicable. The cumulative effective full power and years shall be determined at least once per 18 months.

FIGURE 3.4.6.1-1
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

Insert 3.4.6.1-1

NORMAL OPERATION WITH CORE NOT CRITICAL



BASES:

1. FUEL IN REACTOR
2. ≤ 16 EFPY
3. 7.1×10^{17} N/CM^2 > 1 MEV
4. RT_{NDT} = 93° (1/4 T)
5. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED
6. REG. GUIDE 1.99 REV. 2

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES

Insert 3.4.6.1 - 1

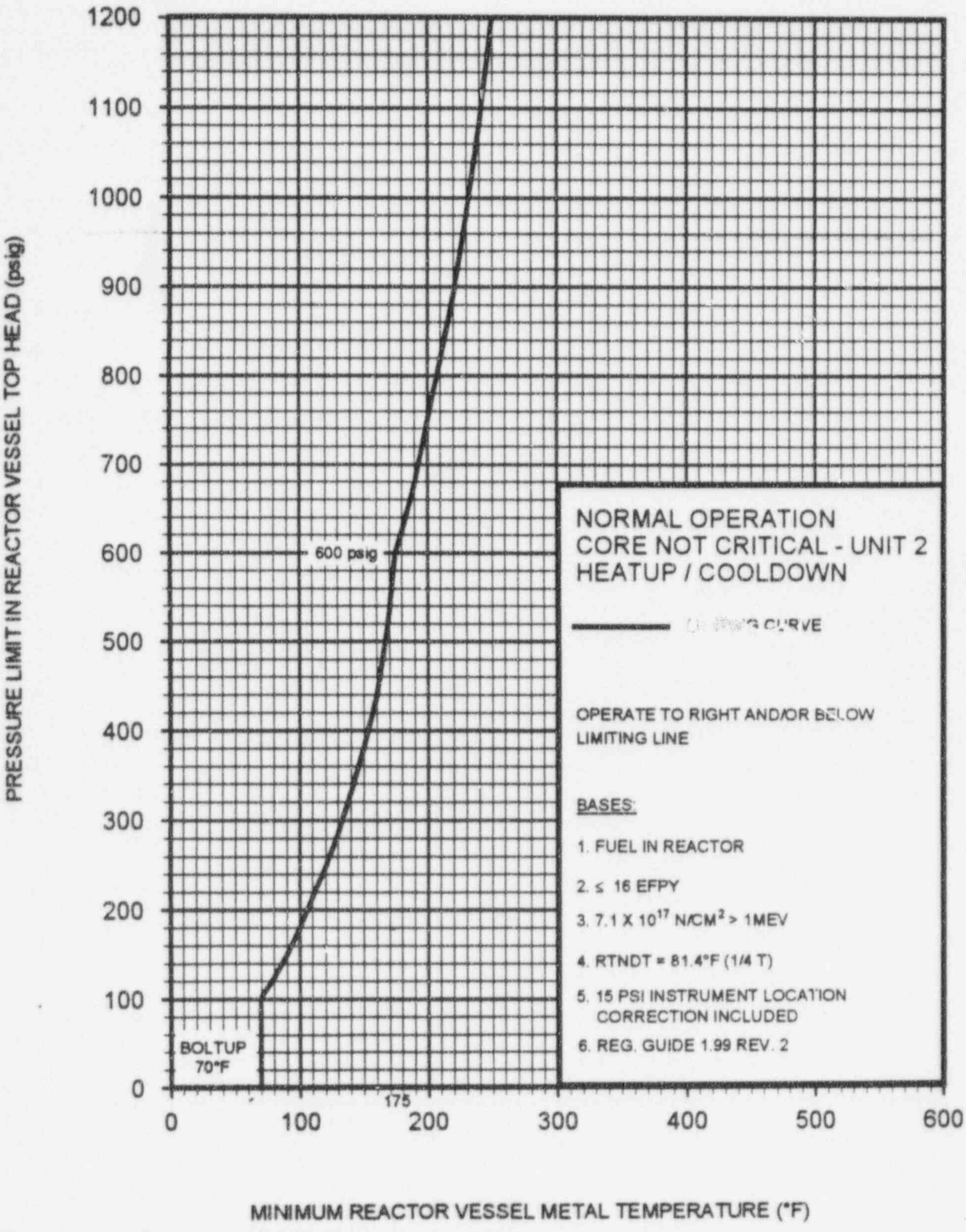
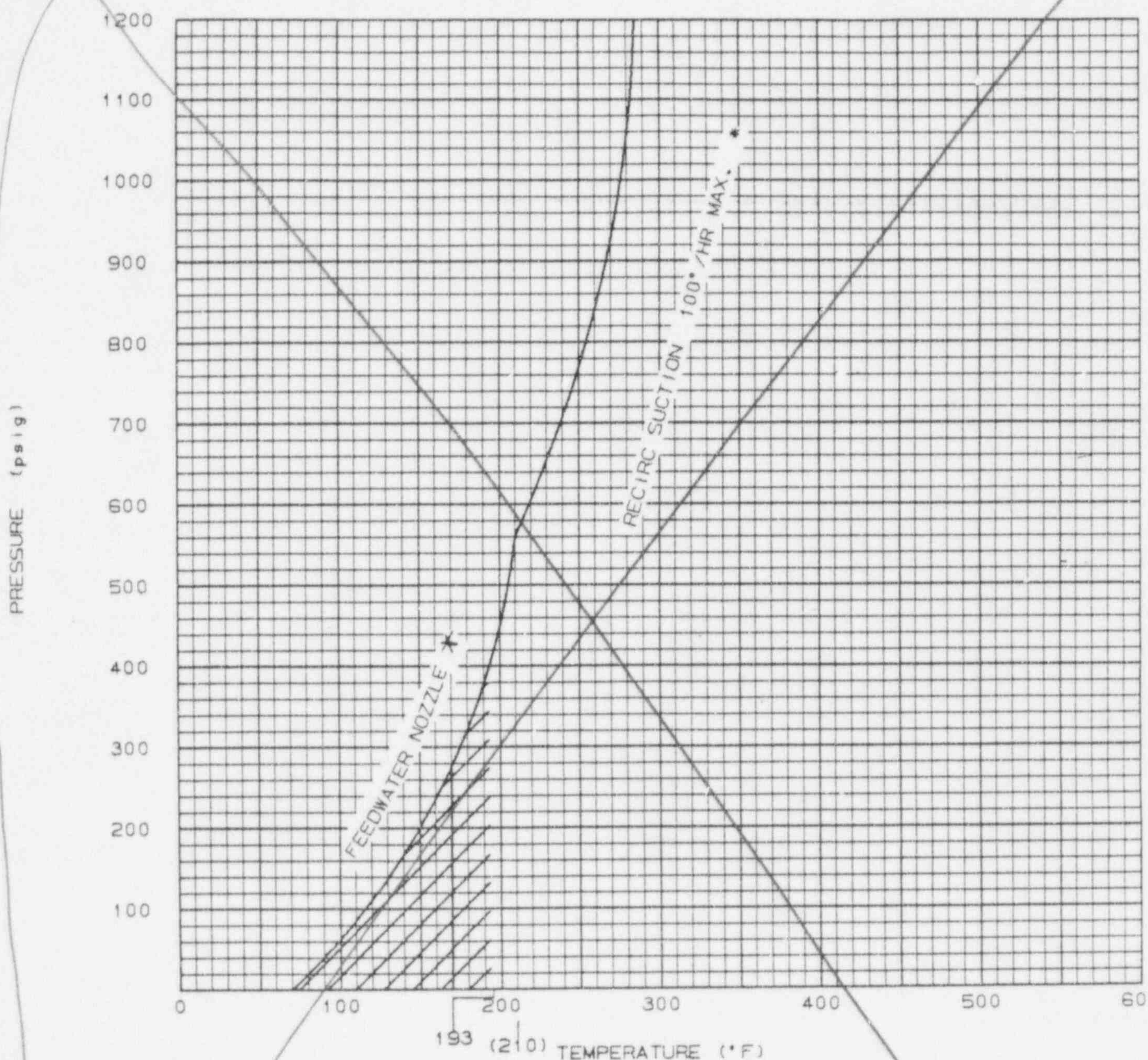


FIGURE 3.4.6.1-2
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

Insert 3.4.6.1-2

NORMAL OPERATION WITH CORE CRITICAL



BASES:

1. FUEL IN REACTOR
2. ≤ 16 EFPY
3. 7.1×10^{17} N/CM^2 > 1 MEV
4. RT_{NDT} = 93° (1/4 T)
5. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED
6. REG. GUIDE 1.99 REV. 2

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES
4. OPERATION IN CROSS-HATCHED AREA PERMITTED ONLY WHEN WATER LEVEL IS WITHIN NORMAL RANGE FOR POWER OPERATION.

Insert 3.4.6.1 - 2

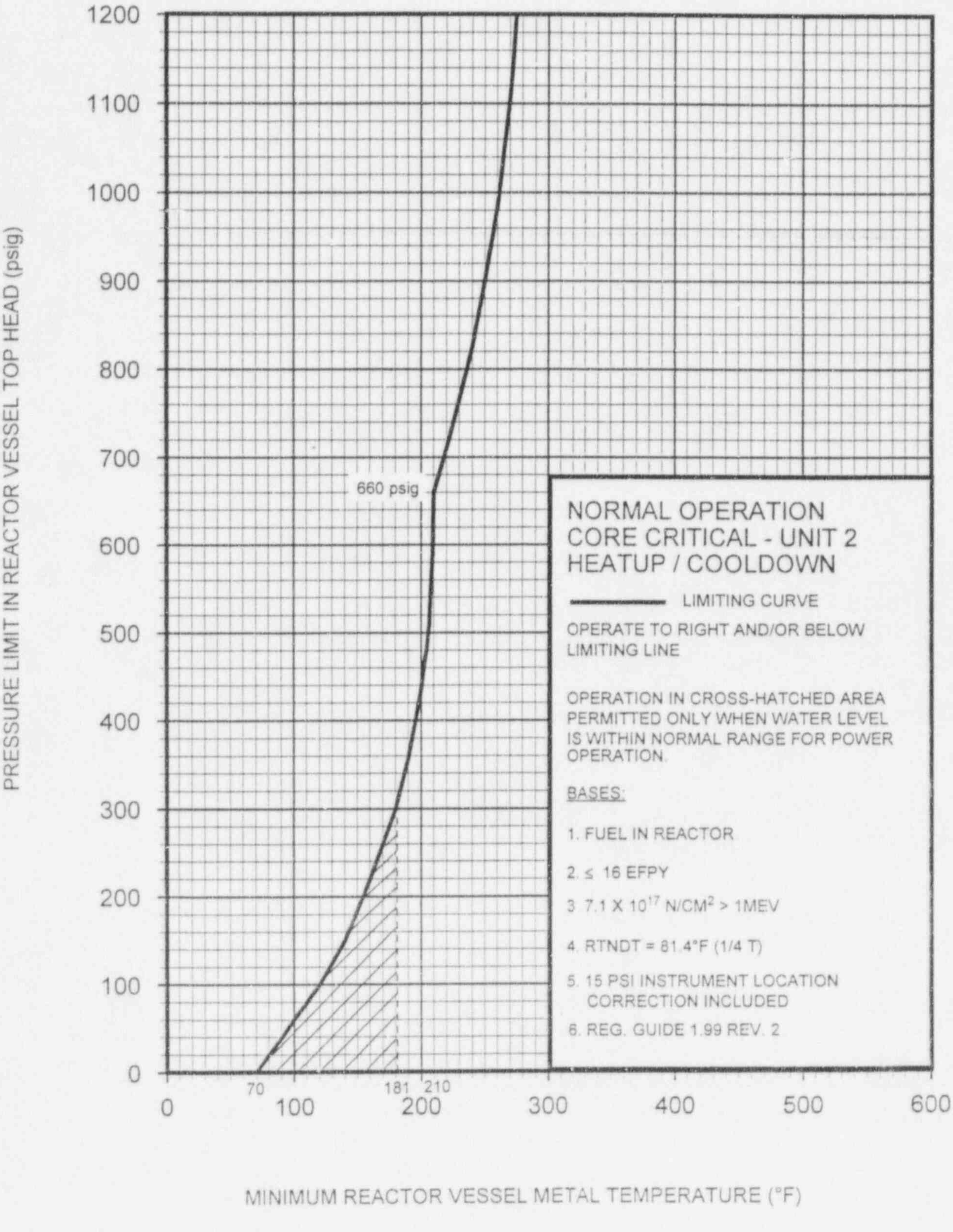
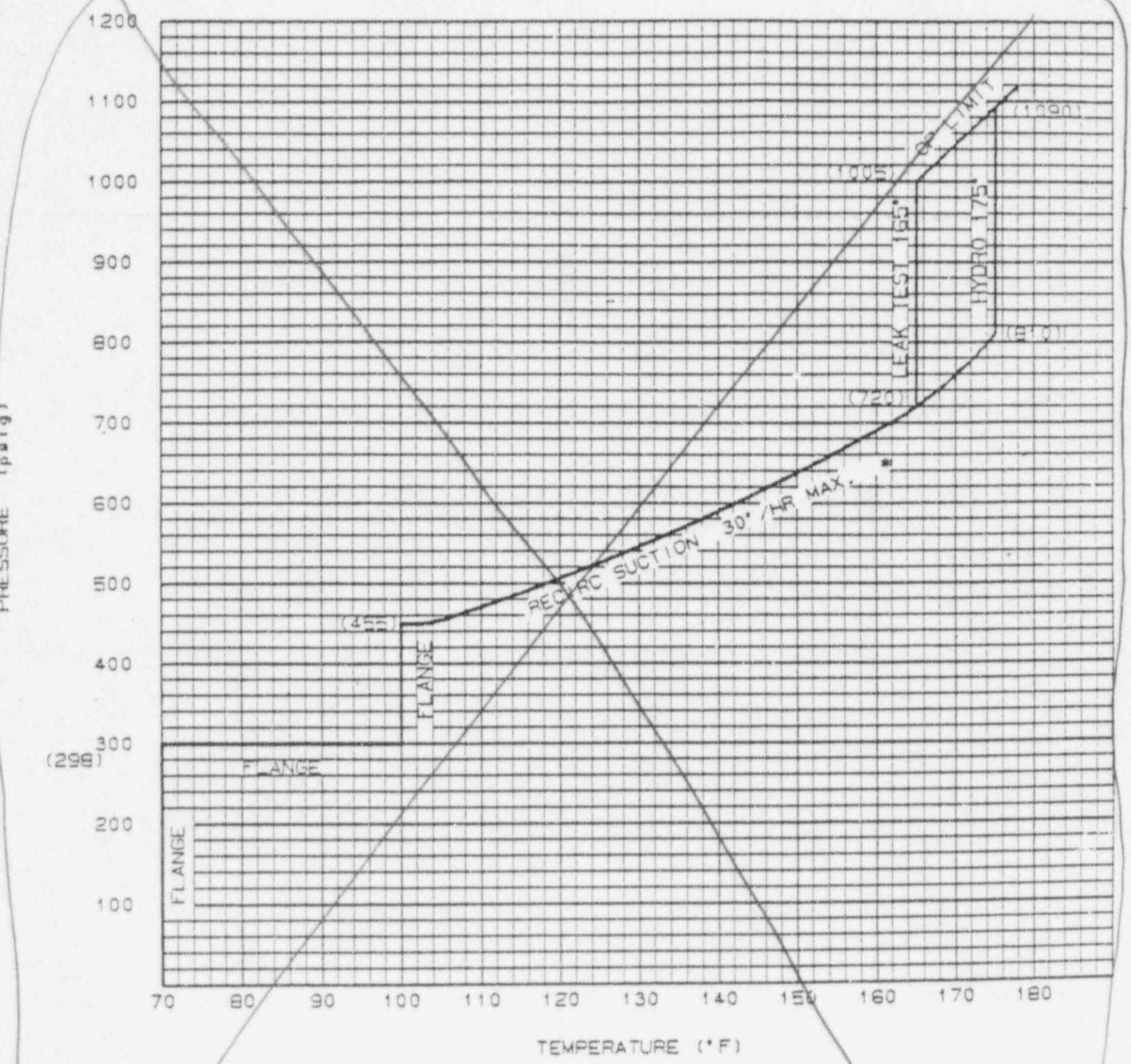


FIGURE 3.4.6.1-3a
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

Insert 3.4.6.1-3a

HYDROSTATIC AND LEAK TESTS



BASES:

1. FUEL IN REACTOR
2. REACTOR NOT CRITICAL
3. REG. GUIDE 1.99 REV. 2
4. ≤ 8 EFPY
5. 3.5×10^{17} N/CM^2 > 1 MEV
6. RT_{NDT} = 77° (1/4 T)
7. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES
4. OPERATING LIMIT INDICATES TEMPERATURE REQUIRED IF TEST PRESSURE WAS EXCEEDED.

Insert 3.4.6.1 - 3a

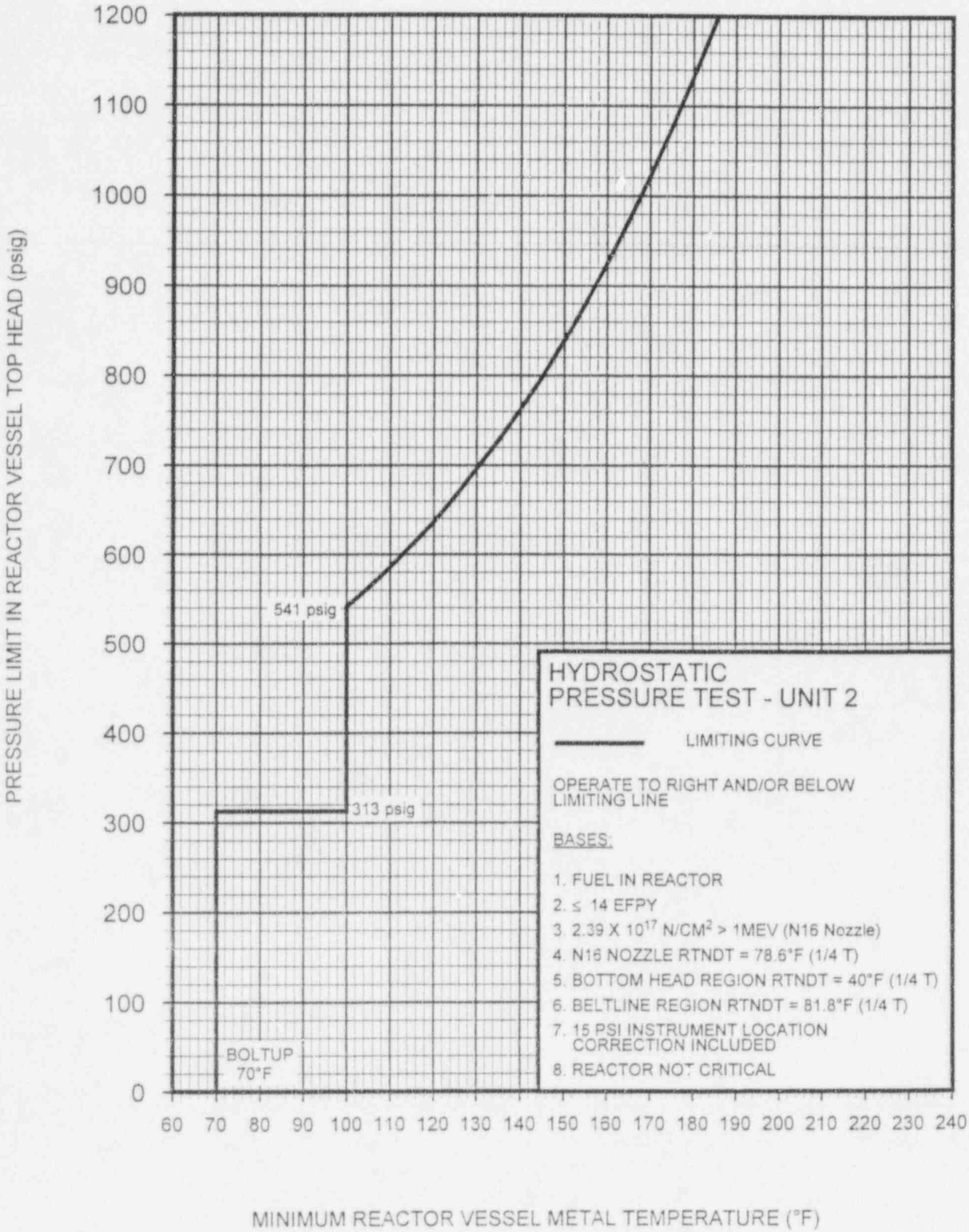
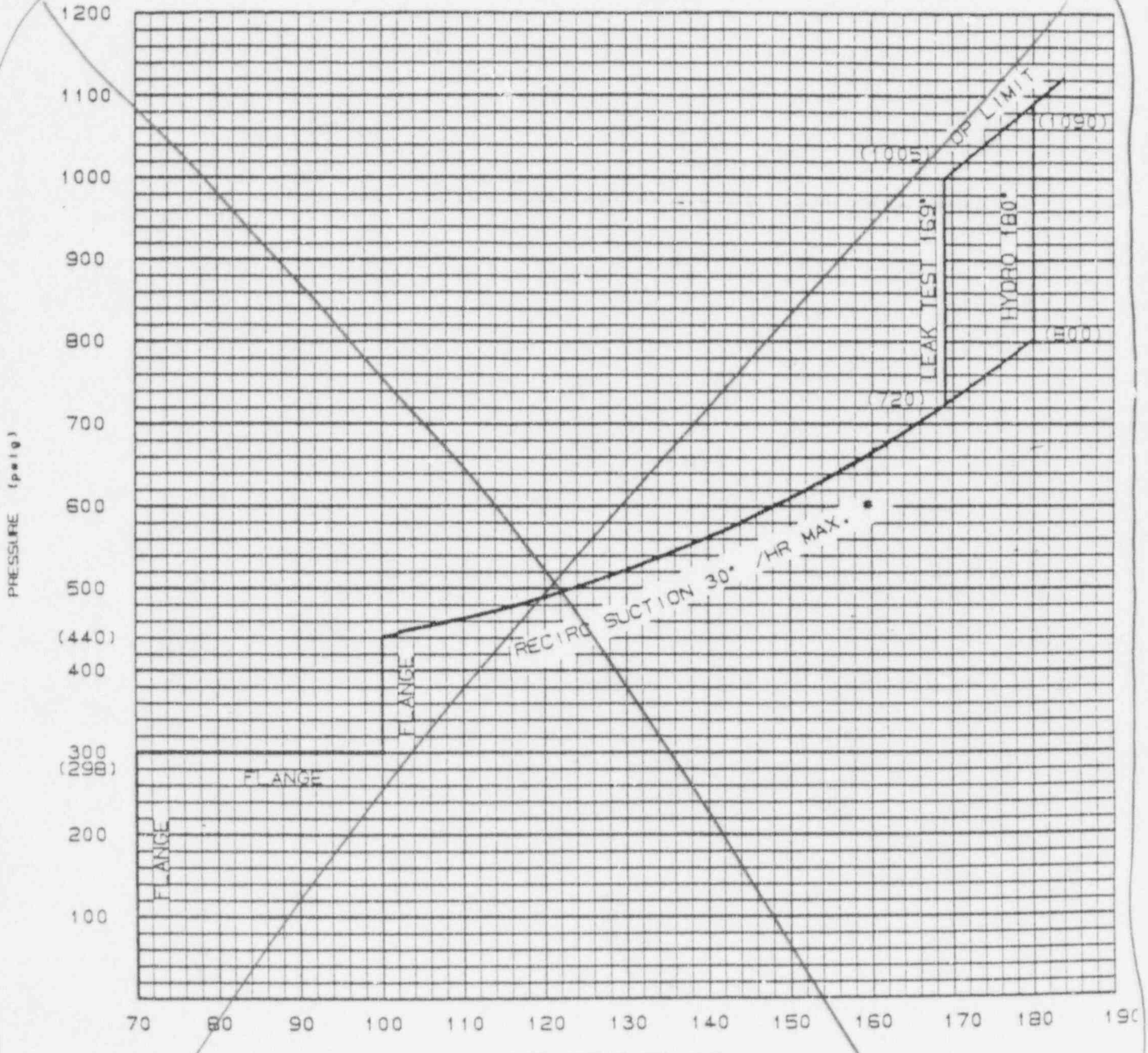


FIGURE 3.4.6.1-3b
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

Insert 3.4.6.1-3b

HYDROSTATIC AND LEAK TESTS



BASES:

1. FUEL IN REACTOR
2. ≤ 10 EFPY
3. 4.4×10^{17} N/CM^2 > 1 MEV
4. RT_{NDT} = 82° (1/4 T)
5. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED
6. REG. GUIDE 1.99 REV. 2
7. REACTOR NOT CRITICAL

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES
4. OPERATING LIMIT INDICATES TEMPERATURE REQUIRED IF TEST PRESSURE WAS EXCEEDED.

Insert 3.4.6.1 - 3b

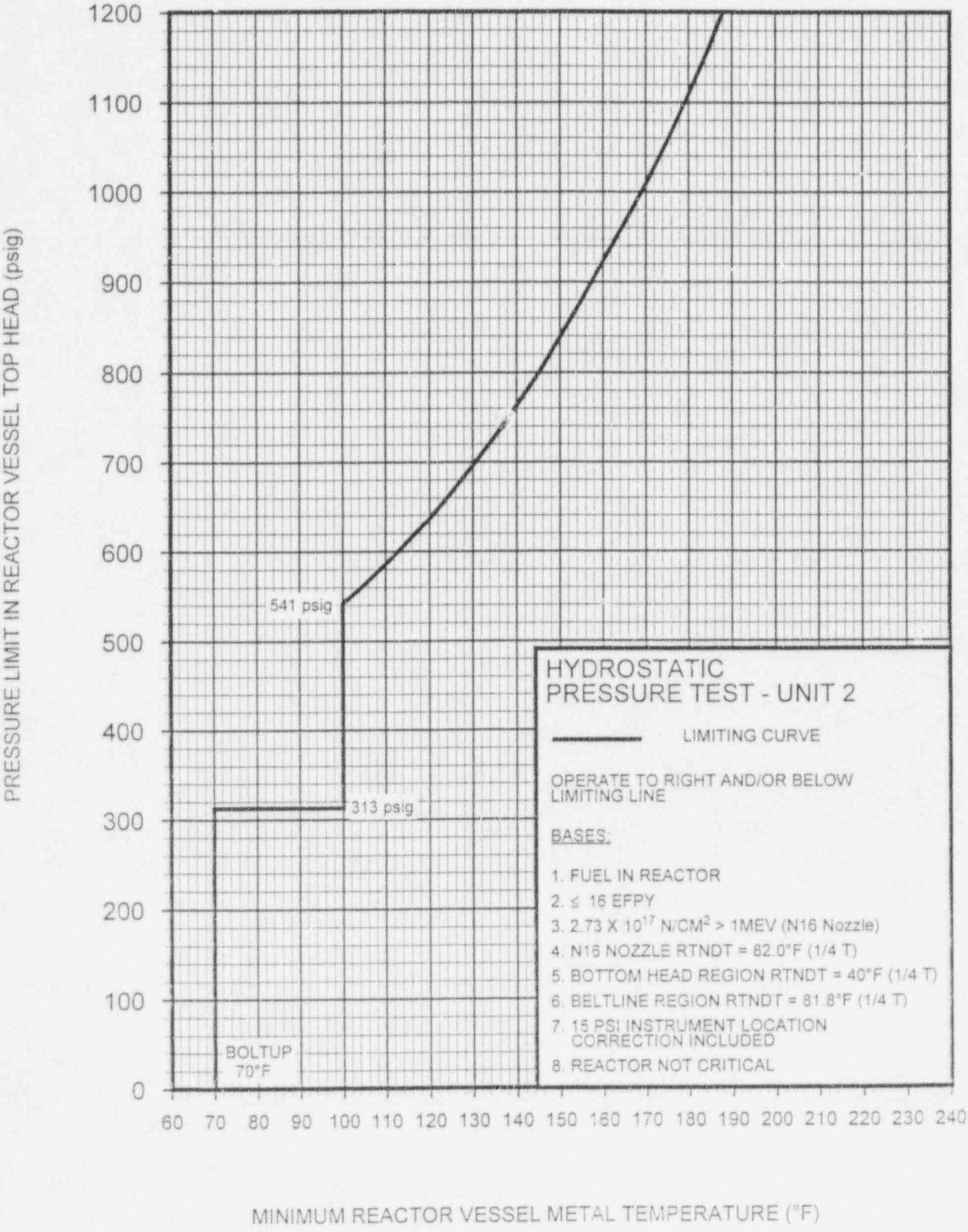


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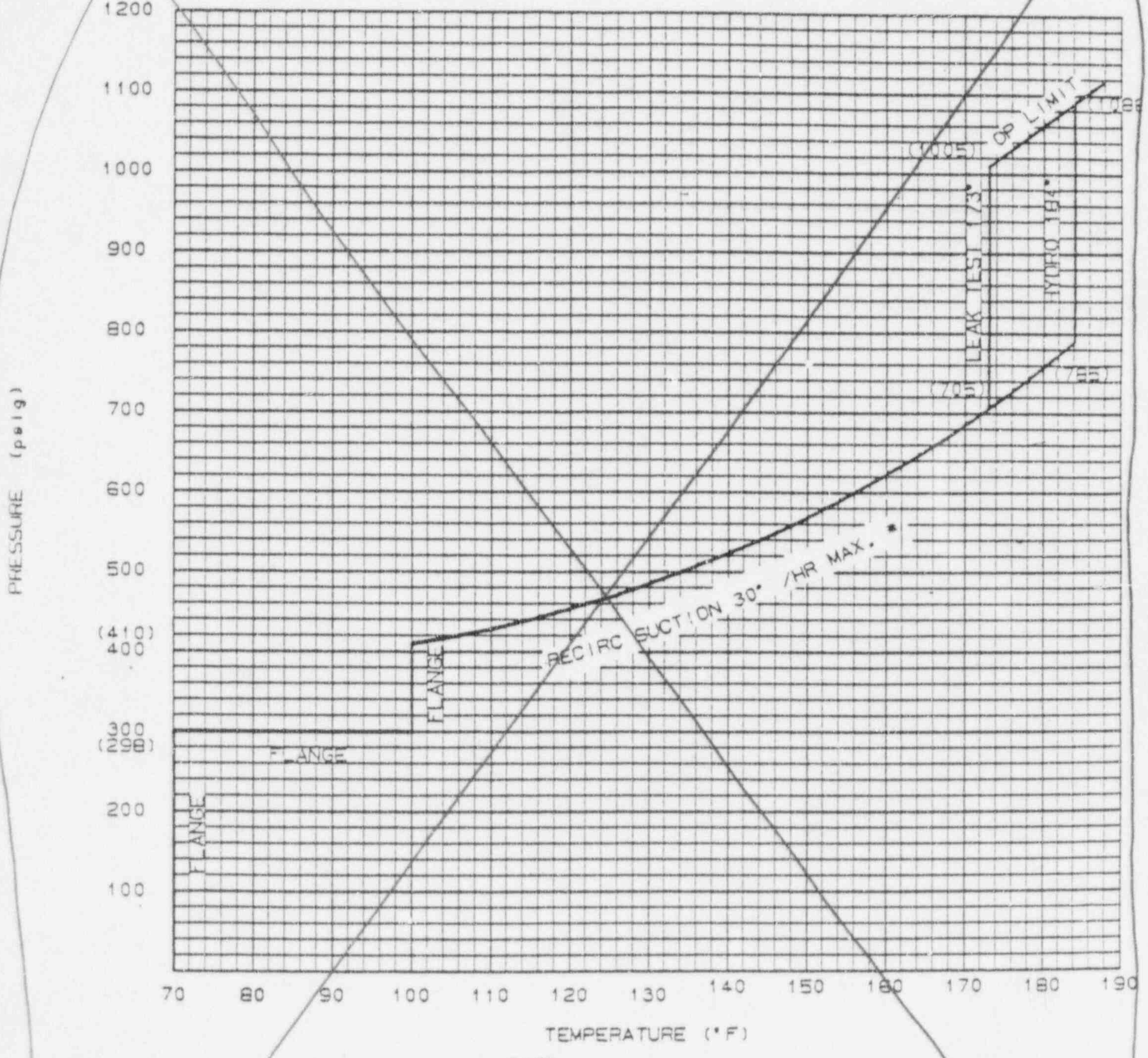
FIGURE 3.4.6.1-3c
PRESSURE-TEMPERATURE LIMITS
REACTOR VESSEL

HYDROSTATIC AND LEAK TESTS



BASES:

1. FUEL IN REACTOR
2. ≤ 12 EFPY
3. 5.3×10^{17} N/CM^2 > 1 MEV
4. RT_{NDT} = 86° (1/4 T)
5. 15 PSI INSTRUMENT LOCATION CORRECTION INCLUDED
6. REG. GUIDE 1.99 REV. 2
7. REACTOR NOT CRITICAL

NOTES:

1. OPERATE TO RIGHT AND/OR BELOW LIMITING LINES
2. * INDICATES BOTH HEATUP AND COOLDOWN RATE
3. PRESSURE AND TEMPERATURE INTERSECTIONS NOTED BY PARENTHESES
4. OPERATING LIMIT INDICATES TEMPERATURE REQUIRED IF TEST PRESSURE WAS EXCEEDED.

PRESSURE/TEMPERATURE LIMITS (Continued)

start-up and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

During heatup, the thermal gradients in the reactor vessel wall produce thermal stresses which vary from compressive at the inner wall to tensile at the outer wall. Thermally induced compressive stresses tend to alleviate the tensile stresses induced by the internal pressure. During cooldown, thermal gradients to be accounted for are tensile at the inner wall and compressive at the outer wall.

24157, Revision 2.

The reactor vessel materials have been tested to determine their initial RT_{NDT}. The results of these tests are shown in GE NEDO 24161. Reactor operation and resultant fast neutron, E>1 Mev, fluence will cause an increase in the RT_{NDT}. Therefore, an adjusted reference temperature, based upon the fluence, can be predicted using the proper revision of Regulatory Guide 1.99. The pressure/temperature limit curves Figures 3.4.6.1-1, 3.4.6.1-2, and 3.4.6.1-3a, through 3.4.6.1-3c include predicted adjustments for this shift in RT_{NDT} at the end of indicated EFPY, as well as adjustments to account for the location of the pressure-sensing instruments.

, and

b

The actual shift in RT_{NDT} of the vessel material will be checked periodically during operation by removing and evaluating, in accordance with ASTM E185-82, reactor vessel material irradiation surveillance specimens installed near the inside wall of the reactor vessel in the core area. Since the neutron spectra at the irradiation samples and vessel inside radius vary little, the measured transition shift for a sample can be adjusted with confidence to the adjacent section of the reactor vessel.

, and b

The pressure/temperature limit lines shown in Figures 3.4.6.1-1, 3.4.6.1-2, and 3.4.6.1-3a through 3.4.6.1-3c have been provided to assure compliance with the minimum temperature requirements of the 1983 revision to Appendix G of 10CFR50. The conservative method of the Standard Review Plan has been used for heatup and cooldown.

The number of reactor vessel irradiation surveillance specimens and the frequencies for removing and testing these specimens are provided in Table 4.4.6.1.3-1 to assure compliance with the requirements of ASTM E185-82.