



MAIN SEAL STRAIN DETERMINATION

SUBJECT: Process Specification

SUPERSEDES Nov. 11, 1949

This specification applies to the process of determining the strain in glass after sealing button stem into tube and is intended as a control check on glass strain.

SCHEDULE NO. 1

MAY 1955

1. EQUIPMENT

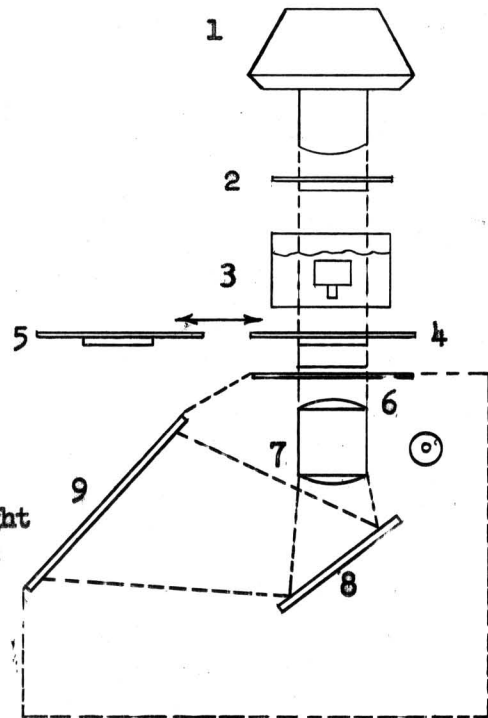
A projection polariscope of the immersed sample type. Its new design has a vertical light beam pointing downward through a lens and mirror system, which is enclosed in a metal housing. Although it is limited in versatility, its convenience of operation is the result of a design primarily for the purpose herein described. It is a product of the Polarizing Instrument Company, Mount Kisco, New York. Its essential parts, along with other required equipment are described below:

Legend:

1. Lamp Housing
2. First Polaroid (Fixed)
3. Immersed Sample
4. Tint (color) Plate
5. 1/4 Wave Plate
6. Second Polaroid (Adjustable)
7. Projection Lenses
8. Mirror
9. Viewing Screen

Except for a knob on the lower right hand side of the enclosure for limited focus of lens "7", only one adjustment is required for strain determination.

Strain determination is obtained by rotating the Second Polaroid with a linked knob on the top right side of the cabinet. The reading is taken from a large dial graduated in 360° divisions. It is marked 0-180 in each direction of rotation.



For best results it is imperative that the following rules be adhered to:

1. The liquid should be clean, clear, and free from foreign matter.
2. The liquid is an active solvent for paint, varnishes, plastics, etc. Handle it Carefully!!
3. The visible lenses should be kept clean with lens tissue and a camel hair brush. Important - The instrument is not air tight. Serious difficulties will be encountered if there is dust or any foreign matter on the enclosed mirror and projection lenses. These are accessible by removing top cover of the housing, (not the small lens platform). Clean with the camel hair brush only. These items should be cleaned at least once every three months, and more if necessary.
4. The chain linkage, knob shaft, idler lever, and main bronze bearing should be carefully inspected, and kept lubricated.

SCALE—

DIMENSIONS IN

* Data Rearranged.

UNLESS OTHERWISE SHOWN.

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MAIN SEAL STRAIN DETERMINATION

SUBJECT: Process Specification

1. EQUIPMENT (Cont'd)

Formerly pg. 2

For best results it is imperative that the following rules be adhered to:
(Cont'd)

5. The vessel containing the immersion liquid must have a strain-free bottom face. For convenience, available photocathode bulbs from orthicons are being used successfully.
6. The immersion liquid is Technical Grade Chlorobenzene.
7. A sample holder of stainless steel sheet was made with an outer circular band to just fit inside the glass vessel. The band has three radial fins attached, which have inner edges shaped to the contour of the sample which automatically support the sample vertically and in focus.

2. PROCEDURE

a. Principle

1. For types which employ a copper exhaust tubulation, with an attached sleeve of chromium-nickel-iron alloy to which is sealed the glass button stem, three strain determinations have been considered essential for control of stem and seal quality:
 - a. A circular region adjacent to the chrome-iron and glass seal, extending radially outward for about 1mm from the metal shall have a minimum tension strain.
 - b. Between this circular zone, and extending to the seal area, a circular band in the fillet button area shall have a compression strain not to exceed a prescribed maximum.
 - c. A reasonably neutral strain condition is desired in the seal area with a maximum limit prescribed.

b. Preparing Samples:

1. The mount should be truly representative of current production.
 - a. It should be made with a stem from the same lot.
 - b. It may be a complete mount with bulb spacers, or a plain stem.
 - c. It should be regularly preheated for approximately 7 minutes.
2. The glass neck must simulate the effect of a complete bulb.
 - a. It should be a full 7-1/4" long to be properly grasped by bulb holder jaws.
 - b. It should have the usual flared neck at cullet end.
 - c. About 4" should extend below the lower edge of the jaws to provide a cullet of proper weight and length.
3. The two components are to be inserted in the machine and sealed in the regular manner. After sealing and removal from the machine, the sample should be allowed to cool until it can be handled in the bare hand. Any seals which are excessively crooked, gobbled, or chipped, should be rejected and a new sample sealed.
4. The excess length of copper tubulation is cut off to within 1/2" of the bottom of the button using a Ridgid #000 pipe cutter. Extreme care should be used to avoid damage to the alignment of chrome-iron and copper sleeves, as the strain pattern will be distorted, or the seal stripped.

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2. PROCEDURE (Cont'd)

b. Preparing Sample (Cont'd)

5. The neck should be cut at a point 1" from the top of the sleeve. This is done by application of the energized hot wire cutter for about 30 seconds, followed by contact with a wet sponge. The excess glass will usually fall off.
6. If a mount was sealed, use an end cutter to sever the two mount support leads, the G₁ and G₂ connections, and the cathode tab. The mount should slip off the stem, which is then ready for strain determination.

c. Performing Test

1. With the sample immersed, set the dial at zero, and the plate selector lever to the rear position. At this setting, the tint plate is introduced into the optical system, and all three strain conditions appear in color. The intensity of each color will reveal the approximate degree of strain in the three important areas.
2. Button Compression - Pull plate selector lever on top to the front position to remove tint plate from and to introduce 1/4 wave plate into the optical system. Light blue-gray areas will be seen in the fillet zone in both horizontal and vertical planes around the tubulation. Rotate the dial clockwise until the horizontal areas to right and left of the tubulation are just extinguished to brown.
3. The strain in millimicrons is 3 times this dial reading. To confirm the reading, return the dial to zero, and extinguish the vertical areas above and below the tubulation by rotating the dial counter-clockwise.
4. Sleeve Tension - The narrow area adjacent to the sleeve is evaluated in the same manner as in "2" above, except that the direction of rotation of the dial from the zero setting is reversed, or the area extinguished is in the next quadrant. Tension is always seen 90° away from compression. Care should be taken to insure that the tubulation is held parallel to the light beam, and that an even pattern is evaluated.
5. Seal Strain - Position the sample so that tubulation is pointed downward to the right at 45° with light beam passing through bottom seal area without interference from glass at top. With the plate selector lever at rear position to introduce tint plate, a blue-green color indicates seal tension, the normal lavender color indicates a neutral condition, and an extension of the yellow of the fillet area shows the seal in compression.
6. To evaluate tension, draw plate selector lever forward and set dial at zero. Rotate dial counter-clockwise to extinguish blue.
7. The strain in millimicrons is 3 times the dial reading. Examples of various strain conditions are shown on page 1c.

→ SCALE— * Data Rearranged.

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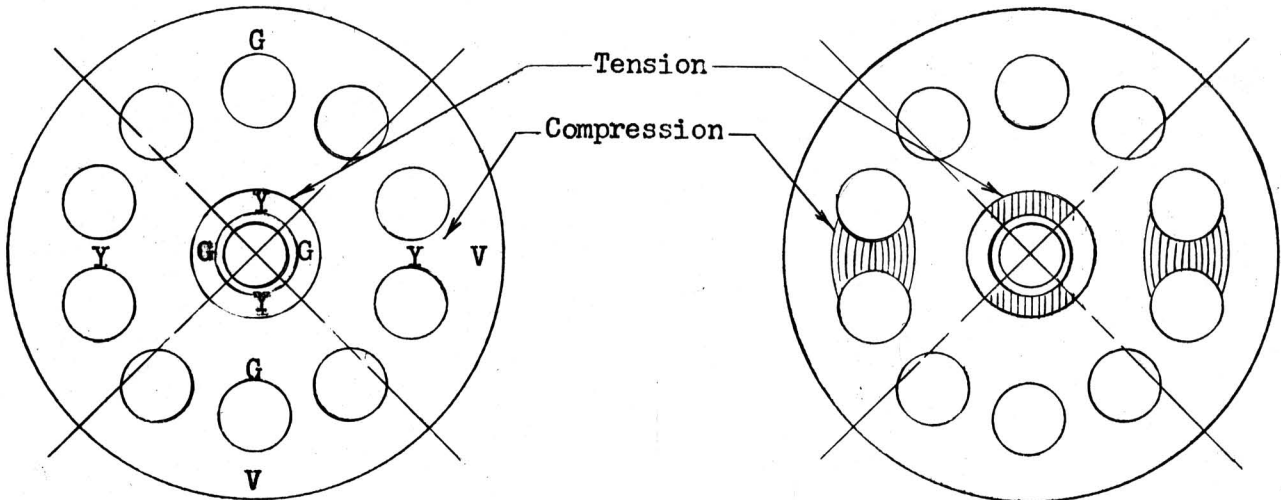
READING SEAL SLEEVE TENSION AND BUTTON COMPRESSION

COLOR WITH TINT PLATE

EVALUATE WITH 1/4 WAVE PLATE

DIAL AT "0"

MAY 1955



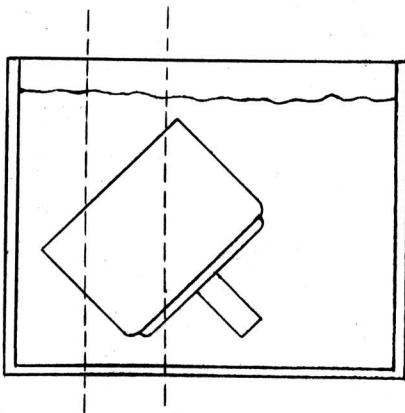
G = GREEN
 Y = YELLOW
 V = VIOLET

DIAL SLIGHTLY CLOCKWISE
 LIGHT AREAS PARTLY EXTINGUISHED

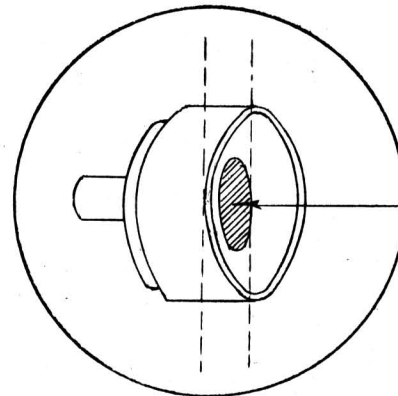
NORMAL

Button area in compression
 Sleeve area in tension
 Seal area neutral

READING SEAL STRAIN



POSITION OF SAMPLE
FRONT VIEW



VIEW IN SCREEN

Usual
 Strain
 Location
 If Tension
 Is Present

→ SCALE—

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13D26—R1



MAIN SEAL STRAIN DETERMINATION
 SUBJECT: Process Specification

MAY 1955

2. PROCEDURE (Cont'd)

d. Strain Limits

1. General

- a. It has been found impractical to establish single, finite limits in terms of a given reading in millimicrons.
- b. Because of the limitations in the accuracy of the method, very frequently too much liberality of interpretation of the reading has been taken, with a resultant production of scrap.
- c. Both stems, and the individual machines display variations in characteristic to produce unusual strain results.
- d. Therefore, a limit system based on duplicate samples, and a control zone have been adopted in place of single figures for the limits of compression and tension.
- e. A second feature of the new system recognizes a frequent relationship between button compression and sleeve tension. This is the origin of the arc in the diagram which defines the limit of the control zone connecting these two characteristics.

2. Button compression and sleeve tension:

- a. The chart on page 1e defines the action required for any reasonable combination of strains.

Zone "A" - Process and parts under control.

Zone "B" - Permits continuation of production, but requires that dummies be run and fire adjustments made until at least one sample has readings within Zone "A".

Zone "C" - Reject Zone - Stop production, but run dummies only until fire adjustments produce at least two samples in Zone "B", or one in Zone "A".

- b. A normal corrective measure for low sleeve tension has been to increase the temperature of the fire immediately after the cut-off position. For high compression, reduce the second and fourth fires after cut-off.

3. High seal tension limits:

- a. Reject Zone - Above 45 M₁ compression.
- b. Approve Zone - From 45 M₁ compression to 9 M₁ tension inclusive.
- c. Retest and Adjust Zone - Above 9 to 45 M₁ tension inclusive.
- d. Reject Zone - Above 45 M₁ tension.
- e. The same operating procedure is to be followed as in the same zones above for button strain.
- f. A common remedy for high seal tension is to raise the temperature of the fourth fire after cut-off position.

→ SCALE— * Data Rearranged.

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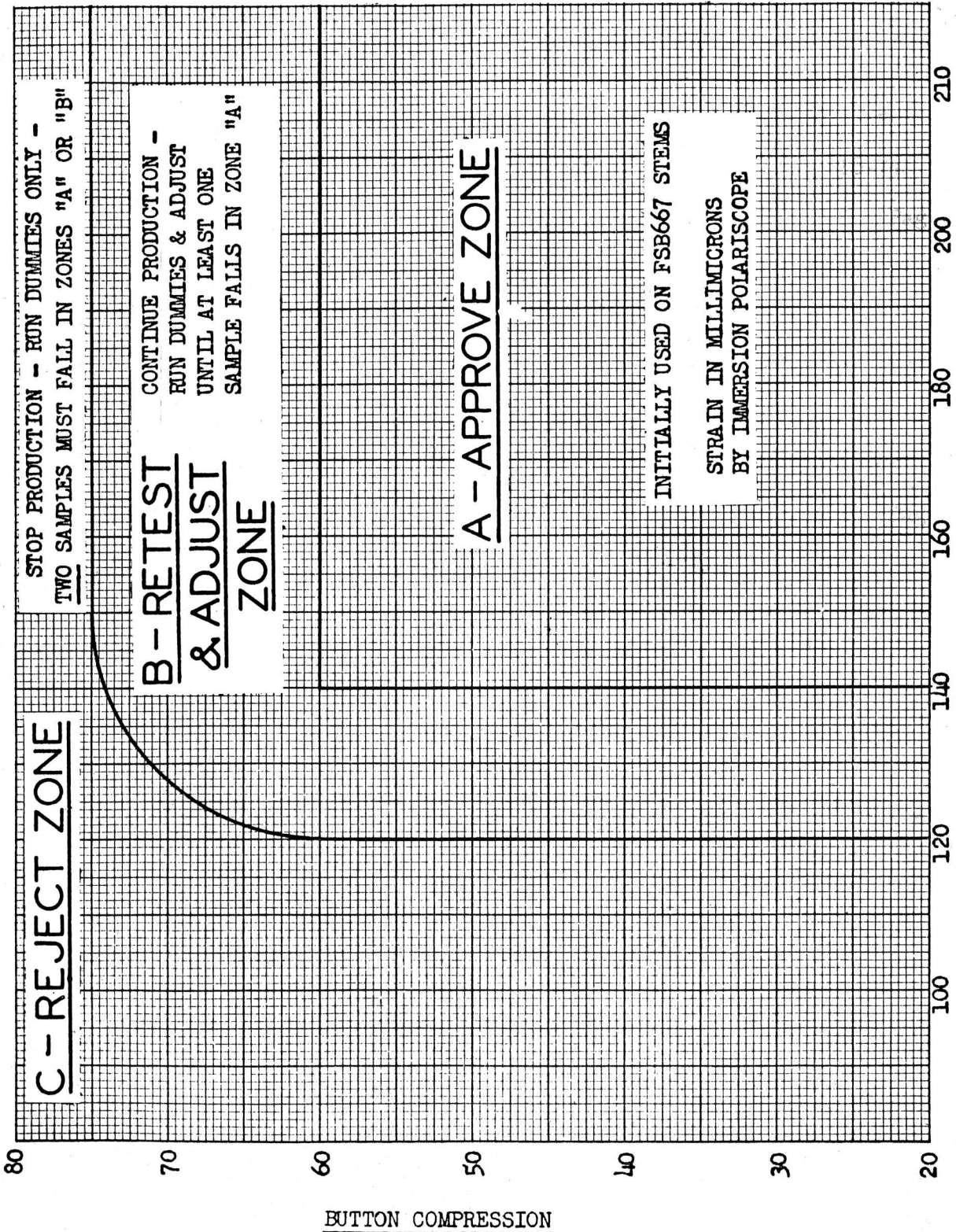


MAIN SEAL STRAIN DETERMINATION

SUBJECT: Process Specifications

MACHINE CONTROL LIMITS

MAY 1955



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SCALE—

End of Schedule No. 1

Dwg. No. 91-401

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MAIN SEAL STRAIN DETERMINATION
 SUBJECT: Process Specification

SUPERSEDES Nov. 15, 1949

SCHEDULE No. 2
 (Initially for Tube Type 15GP22)

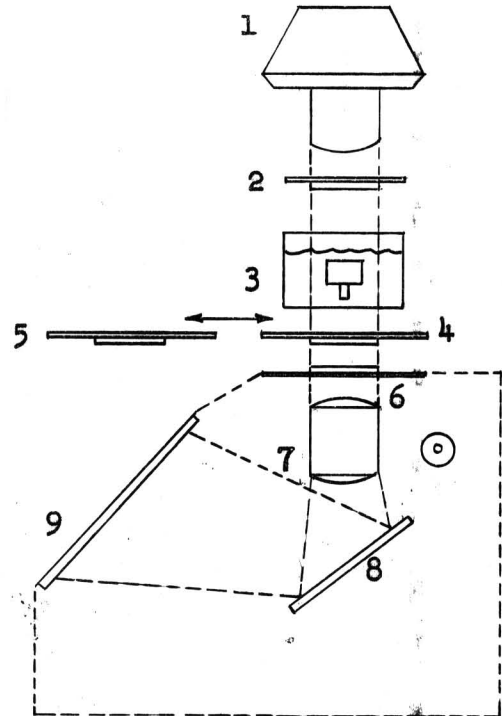
MAY 1955

1. EQUIPMENT: a. Projection Polariscope of the immersed sample type.

Equipment Description: The polariscopes design has a vertical light beam pointing downward thru a lens and mirror system, which is enclosed in a metal housing. Although it is limited in versatility, its convenience of operation is the result of a design primarily for the purpose herein described. It is a product of the Polarizing Instrument Company, Mount Kisco, New York. Its essential parts, along with other required equipment are described below.

Legend:

1. Lamp Housing.
2. First Polaroid (Fixed).
3. Immersed Sample.
4. Tint (color) Plate.
5. 1/4 Wave Plate.
6. Second Polaroid (Adjustable).
7. Projection Lenses.
8. Mirror
9. Viewing Screen



Except for a knob on the lower right hand side of the enclosure for limited focus of lens "7", only one adjustment is required for strain determination.

Strain determination is obtained by rotating the Second Polaroid with a linked knob on the top right side of the cabinet. The reading is taken from a large dial graduated in 360° divisions. It is marked 0-180 in each direction of rotation.

For best results it is imperative that the following rules be adhered to:

1. The liquid should be cleaned, clear, and free from foreign matter.
2. The liquid is an active solvent for paint, varnishes, plastics, etc.
Handle It Carefully!!
3. The visible lenses should be kept clean with lens tissue and a camel hair brush.
Important - The instrument is not air tight. Serious difficulties will be encountered if there is dust or any foreign matter on the enclosed mirror and projection lenses. These are accessible by removing top cover of the housing (not the small lens platform). Clean with the camel hair brush only. These items should be cleaned at least once every three months, and more often if necessary.
4. The chain linkage, knob shaft, idler lever, and main bronze bearing should be

SCALE → carefully inspected, and kept lubricated.
 DIMENSIONS IN UNLESS OTHERWISE SHOWN. DIMENSIONS SHOWN WITHOUT TOLERANCES ARE DESIGN CENTERS

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1. EQUIPMENT (Cont'd)

MAY 1955

Equipment Description (Cont'd)

The vessel containing the immersion liquid must have a strain-free bottom face. For convenience available photo-cathode bulbs from orthicons are used successfully. The immersion liquid is Technical Grade Chlorobenzene. A sample holder of stainless steel sheet was made with an outer circular band to just fit inside the glass vessel. The band has three radial fins attached, which have inner edges shaped to the contour of the sample, which automatically support the sample vertically and in focus.

2. PROCEDURE:

a. Strain Determinations

1. For type 15GP22, and others which employ an OFHC copper exhaust tubulation, with an attached sleeve of chromium-nickel-iron alloy to which is sealed the glass button, three strain determinations have been considered essential for control of stem and seal quality.

- a. A circular region adjacent to the chrome-iron and glass seal, extending radially outward for about 1mm from the metal shall have a tension strain not less than a prescribed minimum.
- b. Between this circular zone, and extending to the seal area, a circular band in the fillet button area shall have a compression strain not to exceed a prescribed maximum.
- c. A reasonably neutral strain condition is desired in the seal area with a maximum limit prescribed.

b. Preparing the Sample

1. Sealing

- a. The mount should be truly representative of current production.
 - 1. It should be made with a stem from the same lot.
 - 2. It may be a complete mount with bulb spacers, or a plain stem.
- b. A complete bulb is to be used, or when possible a glass neck which must simulate the effect of a complete bulb.
 - 1. It should have the usual flared neck at cullet end.
 - 2. About 2" should extend below the lower edge of the button to provide a cullet of proper weight and length.
- c. The two components are to be inserted in the machine and sealed in the regular manner. After sealing and removal from the machine, the sample should be allowed to cool until it can be handled in the bare hand. Any seals which are excessively crooked, gobbed, or chipped should be rejected and a new sample sealed.

2. Cutting

- a. The excess length of copper tubulation is cut off to within 1/2" of the bottom of the button using a Ridgid #000 pipe cutter. Extreme care should be used to avoid damage to the alignment of chrome-iron and copper sleeves, as the strain pattern will be distorted, or the seal stripped.

SCALE—

DIMENSIONS IN

UNLESS OTHERWISE SHOWN.

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MAIN SEAL STRAIN DETERMINATION

SUBJECT: Process Specification

SUPERSEDES

2. PROCEDURE (Cont'd)

MAY 1955

b. Preparing the Sample (Cont'd)

2. Cutting (Cont'd)

- b. The neck should be cut at a point 1" from the top of the sleeve. This is done by application of the energized hot wire cutter for about 30 seconds, followed by contact with a wet sponge. The excess glass will usually fall off.
- c. If a mount was sealed, use an end cutter to sever the two mount support leads, the heater connections, and the cathode tab. The mount should slip off the stem, which is then ready for strain determination.

c. Testing the Sample

- 1. With the sample immersed, set the dial at zero, and the plate selector lever to the rear position. At this setting, the tint plate is introduced into the optical system and all three strain conditions appear in color. The intensity of each color will reveal the approximate degree of strain in the three important areas.
- 2. Button compression - Pull plate selector lever to the front position to remove tint plate from, and to introduce 1/4 wave plate into, the optical system. Light blue-gray areas will be seen in the fillet zone in both horizontal and vertical planes around the tubulation. Rotate the dial clockwise until the horizontal areas to right and left of the tubulation are just extinguished to brown. The strain in millimicrons is 3 times this dial reading. To confirm the reading, return the dial to zero, and extinguish the vertical areas above and below the tubulation by rotating the dial counter-clockwise.
- 3. Sleeve tension - The narrow area adjacent to the sleeve is evaluated in the same manner as in "2" above, except that the direction of rotation of the dial from the zero setting is reversed, or the area extinguished is in the next quadrant. Tension is always seen 90° away from the compression. Care should be taken to insure that the tubulation is held parallel to the light beam, and that an even pattern is evaluated.
- 4. Seal strain - Position the sample so that tubulation is pointed downward to the right at 45° with light beam passing through bottom seal area without interference from glass at top. With the plate selector lever at rear position to introduce tint plate, a blue-green color indicates seal tension, the normal lavender color indicates a neutral condition, and an extension of the yellow of the fillet area shows the seal in compression. To evaluate tension, draw plate selector lever forward and set dial at zero. Rotate dial counter-clockwise to extinguish blue. The strain in millimicrons is 3 times the dial reading. Examples of various strain conditions are shown on pg. 2d.

SCALE—

DIMENSIONS IN

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SUBJECT: MAIN SEAL STRAIN DETERMINATION
Process Specification

SUPERSEDES

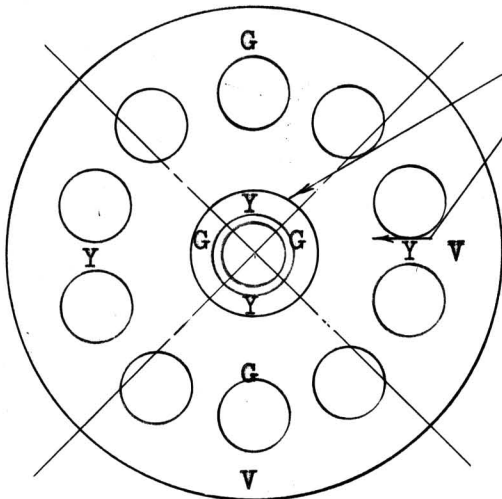
READING SEAL SLEEVE TENSION AND BUTTON COMPRESSION

MAY 1955

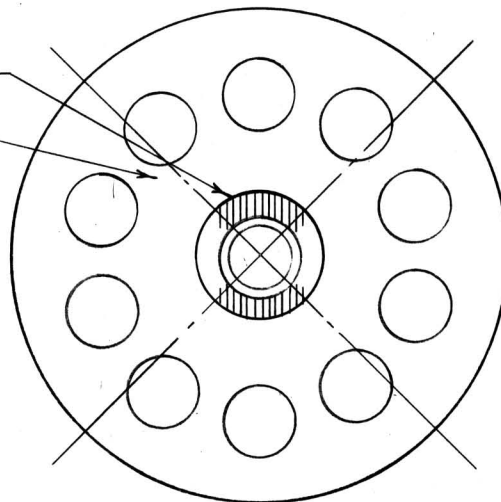
COLOR WITH TINT PLATE

EVALUATE WITH 1/4 WAVE PLATE

DIAL AT "0"



Tension
Compression



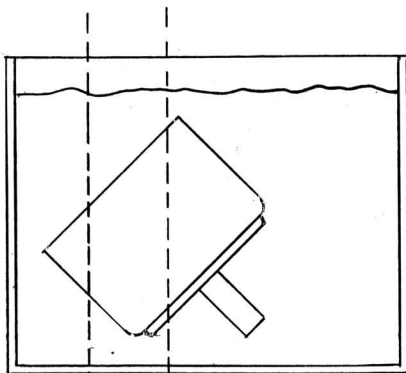
G = GREEN
Y = YELLOW
V = VIOLET

DIAL SLIGHTLY CLOCKWISE
LIGHT AREAS PARTLY EXTINGUISHED

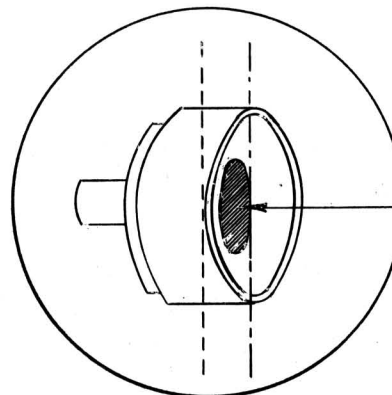
NORMAL

Button area in compression
Sleeve area in tension
Seal area neutral

READING SEAL STRAIN



POSITION OF SAMPLE
FRONT VIEW



VIEW IN SCREEN

SCALE—

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MAIN SEAL STRAIN DETERMINATION

SUBJECT: Process Specification

SUPERSEDES

2. PROCEDURE (Cont'd)

MAY 1955

d. Strain Limits

1. General

- a. It has been found impractical to establish single, finite limits in terms of a given reading in millimicrons.
- b. Because of the limitations in the accuracy of the method, very frequently too much liberality of interpretations of the reading has been taken, with a resultant production of scrap.
- c. Both stems and individual sealing machines display variations in characteristics to produce unusual strain results.
- d. Thus, a limit system based on duplicate samples, and a control zone have been adopted in place of single figures for the limits of compression and tension.
- e. A second feature of the new system recognizes a frequent relationship between button compression and sleeve tension. This is the origin of the arc in the diagram which defines the limit of the control zone connecting these two characteristics.

2. Button Compression and Sleeve Tension

- a. The chart on page 2e defines the action required for any reasonable combination of strains.
 - Zone "A" - Process and parts under control.
 - Zone "B" - Permits continuation of production, but requires that dummies be run and fire adjustments made until at least one sample has readings within Zone "A".
 - Zone "C" - Reject zone - Stop production, but run dummies only until fire adjustments produce at least two samples in Zone "B", or one in Zone "A".
- b. A normal corrective measure for low sleeve tension has been to increase the temperature of the fire immediately after the cut-off position. For high compression, reduce the second and fourth fires after cut-off.

3. High Seal Tension Limits

- a. Reject Zone - above 45 M_μ compression
 Approve Zone - from 45M_μ compression to 15 M_μ tension inclusive.
 Retest and Adjust Zone - Above 15-30 M_μ tension inclusive
 Reject Zone - Above 30 M_μ tension
- b. The same operating procedure is to be followed as in the same zones above for button strain.
- c. A common remedy for high seal tension is to raise the temperature of the fourth fire after cut-off position.

SCALE—

DIMENSIONS IN

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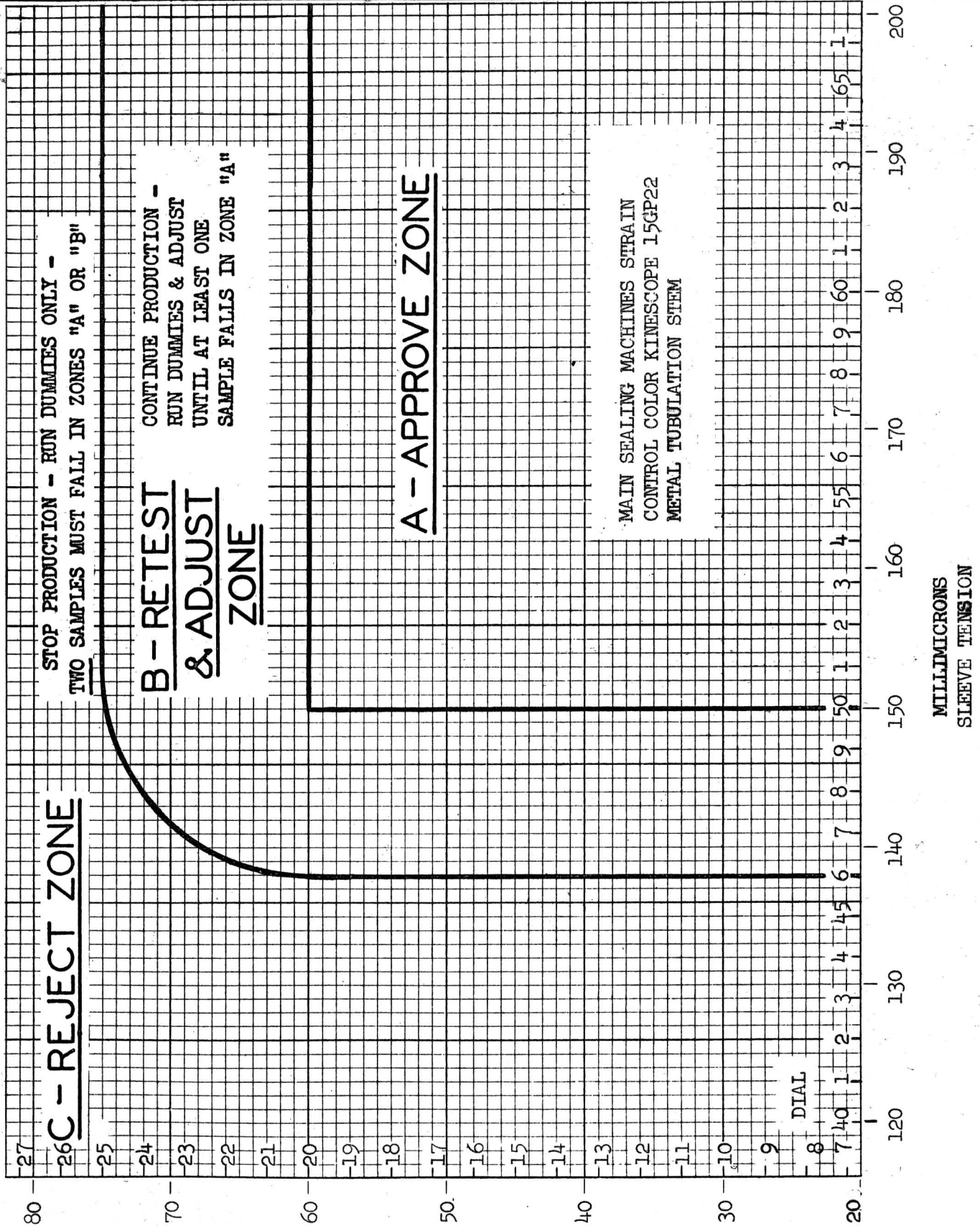


SUBJECT:

MAIN SEAL STRAIN DETERMINATION
Process Specification

SUPERSEDES

MAY 1955



MILLIMICRONS

End of Schedule No 2.

BUTTON COMPRESSION

13-544-5-61

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