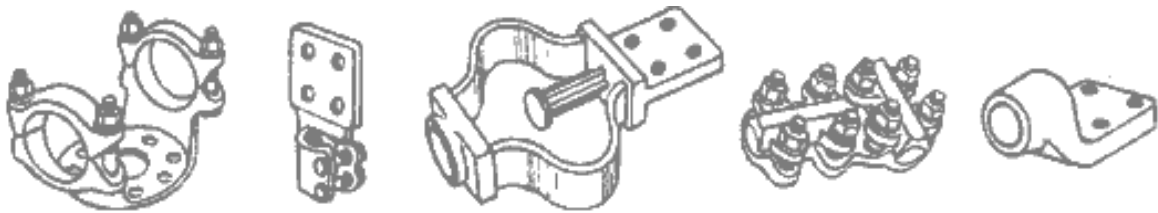

SEFCOR

“The Industry Leader In Service To Our Customers”



QUALITY ASSURANCE MANUAL

VERSION HISTORY

Version	Date	Information	App.
2014.1.0	2014-03-24	Complete Review and Redesign of SEFCOR QA Manual	DWS

PURPOSE

Our Company was established for the purpose of designing and producing electrical power connectors for the electric utility industry.

Although connectors and bus supports are not as complex and costly as the transformers, circuit breakers and switching devices that make up a switchyard or substation, they are vital links in the chain of power transmission. Failure of one connector at a critical place in a power station can cause a temporary shutdown of the entire station.

To meet the requirements for which it was designed, an electrical power connector must be adequate not only in current carrying ability, but also in mechanical strength. To be adequate in one respect and not in the other is of no value.

In order that we may be sure that every one of the thousands of items that pass through the SEFCOR, Inc. shop will meet the requirements for which it was designed, a system of quality standards and uncompromising inspection procedures must be followed.

The reputation of any company rests in the quality of its products and the integrity of those who make them.

Strict adherence to the following quality assurance and inspection procedure is necessary to assure the reliability of our products.

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GENERAL INFORMATION

Quality Assurance is a separate service organization, operating as a staff department under the direction of the Quality Assurance Director, who in turn is directly responsible to Management. In addition, all personnel will operate as de facto inspectors under the guidance of the Quality Assurance Department.

1. DUTIES

The organization of Quality Assurance will perform the following:

- A. Institute and implement quality assurance procedures for the inspection of assemblies and components.
- B. Assure the qualification standards of inspection personnel and provide inspection training through on-the-job training. Provide additional inspection training as necessary to all personnel.
- C. Assure that all assemblies and components conform to applicable contractual requirements and government specifications.
- D. Sufficient records will be maintained for a period of not less than two (2) years in order to show objective evidence of the results of inspection and to indicate if and when corrective action is required. These records will be properly maintained and kept available for review by customer representatives.
- E. Assure instructions for completing and maintaining inspection instructions, forms, and charts.
- F. Transmit all quality assurance information in writing and reproduce necessary copies to acquaint all interested personnel with requirements.

2. INSPECTION PROCEDURES

A. Levels of inspection personnel

The hierarchy of responsibility and duty progress from the worker or operator to the supervisor and then to the Quality Review Board. The Quality Review Board, in order of responsibilities and duties, consists of shop management, Quality Assurance Inspectors, Quality Assurance Director, and Engineering Manager.

B. Inspection Methods

1. General Inspection Methods

The general inspection methods consist of but are not limited to:

- (1) Conformance to drawings and inspection guides
- (2) Identity of product
- (3) General visual appearance

- (4) Electrical and mechanical defects
 - (5) Physical, dimensional and functional characteristics
 - (6) Other quality characteristics which would affect safety
2. Special Inspection Methods
If it is determined that any product or procedure requires special or unique inspection methods then those will be specified in a detailed Inspection Guide.

C. Inspection Actions

1. Any material that appears to be suspect in nature is brought to the attention of the supervisor for review. The supervisor will determine if the material is acceptable, salvageable, scrap or requires further review. If further review is required the material is set aside for inspection by the Quality Review Board.
2. If material is determined to be anything other than acceptable then a review form must be completed and submitted to the Quality Assurance Department.
3. A Corrective Action Report is required to be completed if a defect is recurring in house, recurring from suppliers, reported by a customer, or otherwise determined necessary by the Quality Assurance Department.
4. If material is determined to be anything other than acceptable then it will be removed from production and appropriately handled.

3. ELEMENTS OF QUALITY ASSURANCE

- A. Receiving Inspection
- B. In-process Inspection
- C. Special Process Inspection
- D. Final Inspection
- E. Quality Assurance Record
- F. Corrective Action
- G. Tool, Gage, and Instrument Control
- H. Drawing and Change Control
- I. Control of Subcontracted Supplies
- J. Control of Non-Conforming Material

4. REVISIONS

- A. Any changes in existing practices or institution of new standard practice instructions for operating procedures which related in any way to Quality Assurance practices must be included in this manual after first submitting them through Quality Assurance representatives for approval.
- B. These approved changes will become effective immediately and shall be added as a supplement to this manual with a notation made in the index.

5. PROCEDURE DEVIATIONS

- A. Deviations from procedures herein described will not be permitted except with written permission of the Quality Assurance Director or a designate.

6. SAMPLING PROCEDURES

- A. Sampling procedures for inspection, as stipulated, shall be used by the Inspection Department as indicated by the applicable purchase description or specifications. In the absence of a specified level the following will apply:
 - 1. Receiving Inspection -100% visual inspection
 - 2. In Process Inspection – 100% component inspection
 - 3. Final Inspection - 100% inspection

RECEIVING INSPECTION

1. DUTIES

- A. The duty of Receiving Inspection is to maintain and assure control of all items purchased for fabrication of an end product by SEFCOR, Inc. The Quality Assurance department is responsible for the quality of all material that is furnished to the customers.
- B. The Quality Assurance department will establish and maintain a vendor rating system for each vendor and subcontractor.

2. RECEIVING INSPECTION PROCEDURES

Receiving Inspection procedures include those stated in General Information in addition to the following procedures. If there is a conflict between procedures stated in General Information and this section then the procedures in this section will take precedent.

A. Levels of inspection personnel

The hierarchy of responsibility and duty progress from the worker or operator to the supervisor and then to the Quality Review Board. The Quality Review Board, in order of responsibilities and duties, consists of shop management, Quality Assurance Inspectors, Quality Assurance Director, and Engineering Manager.

B. RECEIVING INSPECTION METHODS

The receiving inspection methods are in addition to those stated in General Information and consist of but are not limited to:

- 1. Conformance to purchase order requirements.
- 2. Conformance to Vendor Guides.

C. RECEIVING INSPECTION ACTIONS

- 1. Any material that appears to be suspect in nature is brought to the attention of the supervisor for review. The supervisor will determine if the material is acceptable, salvageable, scrap or requires further review. If further review is required the material is set aside for inspection by the Quality Review Board.
- 2. A Material Review Form must be completed and submitted to the Purchasing Department for all material regardless of its acceptability.
- 3. If material is determined to be anything other than acceptable then it shall not be issued for production purposes. Accepted material shall be routed to stock, or pulled to fill an order.
- 4. In the event that the rejection rate or salvage rate, or a combination of the two exceeds five percent (5%) of the total quantity received on any

one shipment, definite action by Purchasing will be taken and could include the following actions:

- (1) Require the vendor concerned to notify SEFCOR, Inc. of the corrective action necessary for the assurance of quality products, and that the vendor will complete a Corrective Action Report and furnish this report to SEFCOR.
 - (2) To acquire another source of supply
5. When the purchase order requires that the material conform to certain specifications, the vendor must furnish supporting documents upon request. These documents will state that the materials supplied on a purchased order conform to the required specification.

3. VENDORS AND SUBCONTRACTOR QUALITY RATING

- A. A vendor quality rating will be generated periodically by the purchasing department, based upon the comparison of castings received that meet specifications compared to rejected and/or salvaged castings.
- B. Vendor and subcontractor quality ratings shall be forwarded to invested departments and will form the basis of vendors and/or subcontractors ratings.

IN PROCESS INSPECTION

1. DUTIES

The duty of In-Process Inspection is to inspect those quality characteristics or features of the material which cannot be inspected satisfactorily later in the process of manufacture and/or assembly. In-Process Inspections shall be performed at specific steps determined by the Quality Assurance Department with guidance from shop management.

2. IN-PROCESS INSPECTION PROCEDURES

In-Process Inspection procedures include those stated in General Information in addition to the following procedures. If there is a conflict between procedures stated in General Information and this section then the procedures in this section will take precedent.

A. Levels of inspection personnel

The hierarchy of responsibility and duty progress from the worker or operator to the supervisor and then to the Quality Review Board. The Quality Review Board, in order of responsibilities and duties, consists of shop management, Quality Assurance Inspectors, Quality Assurance Director, and Engineering Manager.

B. IN-PROCESS INSPECTION METHODS

The in-process inspection methods are in addition to those stated in General Information and consist of but are not limited to:

1. Shop Travelers will follow the material through all processes. The Shop Travelers will be initialed by operators to indicate that they have been inspected.
2. Grooves, holes and sockets fit appropriate gauges.
3. Internal processes have not caused defects such as those by excessive grinding or filing.

C. IN-PROCESS INSPECTION ACTIONS

1. Any material that appears to be suspect in nature is brought to the attention of the supervisor for review. The supervisor will determine if the material is acceptable, salvageable, scrap or requires further review. If further review is required the material is set aside for inspection by the Quality Review Board.
2. If material is determined to be anything other than acceptable then an In-Process Review Form must be completed and submitted to the Quality Assurance Department.
3. A Corrective Action Report is required to be completed if a defect is recurring in house or otherwise determined necessary by the Quality Assurance Department.

SPECIAL PROCESS INSPECTION

1. DUTIES

The duty of Special Process Inspection is to inspect the quality of special processes such as machining, plating, sand blasting, anodizing, and heat-treating. Special Process Inspections of internal special processes shall be performed at specific steps determined by the Quality Assurance Department with guidance from shop management. Special Process Inspections of external special processes shall be performed upon return of processed material to SEFCOR.

2. SPECIAL PROCESS INSPECTION PROCEDURES

Special Process Inspection procedures include those stated in General Information in addition to the following procedures. If there is a conflict between procedures stated in General Information and this section then the procedures in this section will take precedent.

A. Levels of inspection personnel

The hierarchy of responsibility and duty progress from the worker or operator to the supervisor and then to the Quality Review Board. The Quality Review Board, in order of responsibilities and duties, consists of shop management, Quality Assurance Inspectors, Quality Assurance Director, and Engineering Manager.

B. SPECIAL PROCESS INSPECTION METHODS

The special process inspection methods are in addition to those stated in General Information and consist of but are not limited to:

1. Conformance to inspection guides specific to the special process.
2. Conformance to special instructions from Engineering.

C. SPECIAL PROCESS INSPECTION ACTIONS

1. Any material that appears to be suspect in nature is brought to the attention of the supervisor for review. The supervisor will determine if the material is acceptable, salvageable, scrap or requires further review. If further review is required the material is set aside for inspection by the Quality Review Board.
2. A Material Review Form must be completed and submitted to the Purchasing Department for all material regardless of its acceptability.
3. If material is determined to be anything other than acceptable then it shall not be issued for production purposes. Accepted material shall be routed to stock, or pulled to fill an order.
4. In the event that the vendor rejection rate or salvage rate, or a combination of the two exceeds five percent (5%) of the total quantity

received on any one shipment, definite action by Purchasing will be taken and could include the following actions:

- (1) Require the vendor concerned to notify SEFCOR, Inc. of the corrective action necessary for the assurance of quality products, and that the vendor will complete a Corrective Action Report and furnish this report to SEFCOR.
- (2) To acquire another source of supply
5. The vendor is required to supply certifications with each lot of parts guaranteeing that the special process performed was in accord with all applicable specifications.
6. Records of tests performed at SEFCOR, Inc. shall be maintained within the Quality Assurance Department.
7. Purchasing to request copies of the test reports required by the specifications and/or contracts. Copies of these reports will be kept on file in the Inspection Department.
8. The Inspection Department will be responsible for seeing that the subcontractor of the special process operation has furnished evidence that their operation has been performed according to all applicable specifications.

3. VENDORS AND SUBCONTRACTOR QUALITY RATING

- A. A vendor quality rating will be generated periodically by the purchasing department, based upon the comparison of material received that meet specifications compared to rejected and/or salvaged material.
- B. Vendor and subcontractor quality ratings shall be forwarded to invested departments and will form the basis of vendors and/or subcontractors ratings.

FINAL INSPECTION

1. DUTIES

The duty of Final Inspection is to ensure that items that are ready for shipment have met all quality standards. Final Inspection shall be performed after assembly but before packaging.

2. FINAL INSPECTION PROCEDURES

Final Inspection procedures include those stated in General Information in addition to the following procedures. If there is a conflict between procedures stated in General Information and this section then the procedures in this section will take precedent.

A. Levels of inspection personnel

The hierarchy of responsibility and duty progress from the worker or operator to the supervisor and then to the Quality Review Board. The Quality Review Board, in order of responsibilities and duties, consists of shop management, Quality Assurance Inspectors, Quality Assurance Director, and Engineering Manager.

B. FINAL INSPECTION METHODS

The final inspection methods are in addition to those stated in General Information and consist of but are not limited to:

1. Part numbers are appropriately marked on all parts.
2. All component parts are assembled in accordance to supporting documents.
3. Bolt heads are properly seated.
4. Aluminum contact surfaces are properly coated.
5. Bolt holes are on center.
6. Finished surfaces are not pitted or scarred.
7. Copper face plates are properly bonded to the aluminum.
8. Bolts are properly aligned.
9. Tapped holes for field use fit the “go” gage.
10. Internal processes have not caused defects such as those by excessive grinding or filing.
11. Parts meet other specific characteristics pertinent to the part as designated by Engineering.

C. FINAL INSPECTION ACTIONS

1. Any material that appears to be suspect in nature is brought to the attention of the supervisor for review. The supervisor will determine if the material is acceptable, salvageable, scrap or requires further review. If further review is required the material is set aside for inspection by the Quality Review Board.
2. If material is determined to be anything other than acceptable then an In-Process Review Form must be completed and submitted to the Quality Assurance Department.
3. A Corrective Action Report is required to be completed if a defect is recurring in house or otherwise determined necessary by the Quality Assurance Department.

APPENDIX

- A. TECHNICAL DATA
- B. MANUFACTURING
- C. SPECIFICATIONS FOR FACTORY WELDS
- D. BONDED COPPER FACE PLATE INSTALLATION
- E. SPECIFICATIONS FOR ALUMINUM SAND CASTINGS, ALLOY 356
- F. HEAT TREAT SPECIFICATIONS, ALUMINIUM SAND CASTINGS, ALLOY 356
- G. SPECIFICATIONS FOR BRONZE SAND CASTINGS, ALLOY 85-5-5-5
- H. SPECIFICATIONS FOR ALUMINUM BRONZE SAND CASTINGS, ALLOY 89-1-10
- I. MATERIAL REVIEW FORM
- J. IN PROCESS REVIEW FORM
- K. SHOP TRAVELER
- L. VENDOR SCORECARD
- M. CORRECTIVE ACTION REPORT
- N. INSPECTION GUIDE, ALL CASTINGS

TECHNICAL DATA

1. DESIGN

- A. The design of SEFCOR, Inc. connectors shall be based upon service requirements and shall meet or exceed the criteria set forth in applicable NEMA and ANSI standards.
- B. Materials and alloys specified shall be those which are fully suitable for the application and have been proven and accepted by the industry for such application.
- C. Design consideration shall comprise mechanical requirements, electrical capacity, voltage level, corrosion mechanics, economy, field installation procedures, and specific customer requirements. Manufacturing economy shall not be given priority over quality.

2. FOUNDRY

Castings used in SEFCOR, Inc. products will be electrical bronze, aluminum and ferrous alloys. Each of these material classifications shall be produced in a separated foundry or foundry area. This will assure that the melting, pouring and sand systems are separate from those of other metals. The foundry shall be properly equipped and operated in a manner that will produce consistently acceptable quality castings.

3. ALUMINUM CASTINGS

A. MELT AND POURING

- 1. Castings shall be poured from ASTM certified primary ingot only. Remelt shall not exceed ten percent of any heat.
- 2. Degassing of the melt shall be by means of bottled gas (chlorine or other), not by gas evolving solids.
- 3. Melt and pouring temperatures shall be monitored and controlled within recommended limits for the alloy specified.
- 4. Location of gates and risers shall be the responsibility of the foundry and shall be adequate to assure a sound casting free from internal stresses and voids.
- 5. Cores shall be free from flaws such as chipped edges and flash along parting lines. They shall be properly set and aligned in the mold.

B. CASTING QUALITY

- 1. Castings shall conform to the written SEFCOR, Inc. specifications applicable to the alloy designated.
- 2. Castings shall have gates, risers and flash exceeding 1/16 inch removed at the foundry.

3. Cored holes and surface shall be free from the effects of core shift and improper seating of the core.
4. All cast lettering or marking shall be legible.

C. HEAT TREATMENT

1. Castings shall be heat-treated in a gas or electric oven equipped with a time/temperature recorder so that a permanent record of the heat treat cycle is obtained.
2. Heat treatment time, temperature and quenching procedure shall be in full accordance with the heat treat temper designated on the foundry order, and in accordance with SEFCOR, Inc. Specification No. F-01, Sheet 2.
3. Castings shall be free from warp or buckling caused by improper stacking in the oven.

4. BRONZE CASTINGS

A. MELT AND POURING

1. Castings shall be poured from ASTM certified ingot only. Remelt shall not exceed forty (40) percent of melt. Any imbalance in the alloy caused by remelt losses shall be corrected by the addition of the proper percentage of the metal lost.
2. Melt shall be degassed immediately prior to pouring by the addition of phosphorous or other process acceptable degassing element.
3. Melt and pouring temperatures shall be monitored and controlled within recommended limits for the alloy specified.
4. Location of gates and risers shall be the responsibility of the foundry and shall be adequate to assure a sound casting free from internal stresses and voids.
5. Cores shall be free from such flaws as chipped edges and flash along parting lines. They shall be properly set and aligned in the mold.

B. CASTING QUALITY

1. Castings shall conform to the written SEFCOR specifications applicable to the alloy designated.
2. Castings shall have gates, risers and flash exceeding 1/16 inch removed at the foundry.
3. Cored holes and surfaces shall be free from the effects of core shift and improper seating of the core in the mold.
4. All cast lettering and marking shall be legible.

MANUFACTURING

Manufacturing procedures, control and inspection standards shall be such as to assure the required levels in the finished product. The quality of workmanship evident in the finished product is an indication of the capability and reliability of the SEFCOR, Inc. operation and shall not be considered secondary to material quality or functional adequacy.

1. CASTING INSPECTION

- A. Castings received from foundry shall be visually inspected for conformance to the applicable specifications. Pieces failing to pass inspection shall be rejected and replaced. A record of rejected castings, as well as castings requiring salvage is maintained for each vendor.
- B. Cantilever or other tests shall be performed on representative items when required. Such tests shall be in accordance with written Engineering specifications.

2. CASTING CLEANUP

- A. The purpose of the casting cleanup operation is to remove the undesirable appendages added to the intended shape by casting process.
- B. All flash and the remains of gates and risers shall be removed with sufficient care to restore the proper contours of the cast piece. Unsightly marks from cutting wheels or other tools shall be removed by a sanding or tumbling operation.
- C. The ends of all conductor grooves shall have a smoother 1/8 inch radius. Angular cuts are not acceptable. All sharp edges introduced by gates and risers shall be sanded to 1/16 inch radius. A shot blast operation shall be used to remove discoloration on aluminum castings caused by the heat treatment process. After cleanup, all castings shall be degreased in a commercial solvent.

3. CASTING FINISH

- A. Machining and other finish work shall be in accordance with Engineering assembly drawings including indicated tolerances furnished with the job.
- B. All finished conductor grooves and socket diameters shall be checked against shop gages to assure proper fit.
- C. Cast holes shall be re-drilled to accurate diameters and checked against shop templates for centerline accuracy.
- D. Tinning, when required, shall be by the hot dip process unless otherwise specified.

4. FACTORY WELDING

Welds shall be made in accordance with Engineering assembly drawings. Welding procedure shall be in accordance with SEFCOR, Inc. specifications No. M-01, Sheets 1-3. A first article inspection shall be performed by the welding supervisor, appropriate engineer or a designate of the quality assurance department.

5. ASSEMBLY

- A. Assembly shall be in accordance with the Engineering assembly drawings. A spot check on one assembly of each type shall be made at the beginning of final assembly, using shop gages, to assure proper conductor fit and bolt length requirements.
- B. No substitutions of fasteners or other hardware shall be made without Engineering approval.

6. FINAL INSPECTION

- A. Inspection shall apply to 100 percent of the items in any shipment. Rejection shall be for any reason that, in the opinion of the inspector, the product does not meet the quality levels set forth in these specifications. Reasons for rejection may be one or more of the following:
 - 1. Bolt heads not properly seated
 - 2. Aluminum contact surfaces not properly coated
 - 3. Assembly not fully in accordance with the drawing
 - 4. Bolt holes off center
 - 5. Finished surfaces pitted or scarred
 - 6. Copper face plates not properly bonded to aluminum
 - 7. Bolts not properly aligned
 - 8. Tapped holes for field use not accepting "go" gage
 - 9. Other specific characteristics pertinent to the part as designated by Engineering.

7. PACKING

- A. Products shall be packed and crated for shipment in such a manner as to arrive at the destination free from nicks, scratches, or other damage when subjected to normal handling by commercial carrier.
- B. Connectors having protective grease or paste on contact surfaces shall be individually packaged in clear plastic bags before packing for shipment.

SPECIFICATIONS FOR FACTORY WELDS

1. SCOPE

The specifications cover factory assembly and welding of aluminum electrical bus connectors. In order to meet the design requirements, the weld must have adequate mechanical strength and electrical conductivity as well as the finished appearance of a manufactured item.

2. MATERIALS

In general, the welds join aluminum castings (Alloy 356) to aluminum strip (Alloy 11000) or aluminum tubing (Alloy 6063 or 6061).

3. METHOD

Welds shall be made with either a Metal-Inert-Gas (MIG) system or a Tungsten-Inert-Gas (TIG) system, using alloy 4043 filler rod. The inert gas shall be helium, argon, or a mixture of the two that is best suited to the welding position. A first article inspection of the weld is performed by the department supervisor, engineer or a designated member of the quality assurance department

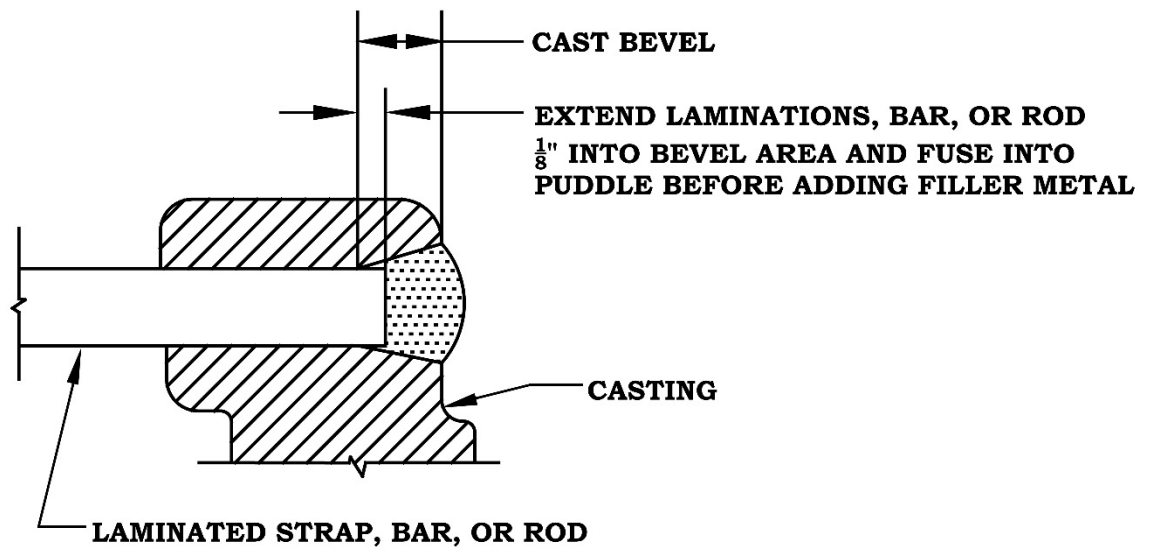
4. PREPARATION OF MATERIAL

Metal surfaces shall be clean, dry and free from heavy oxide films. Parts shall be cleaned with a commercial solvent prior to welding to remove oil and grease. Sanding or brushing with a stainless steel brush shall be used to remove dull oxide film from cast surfaces.

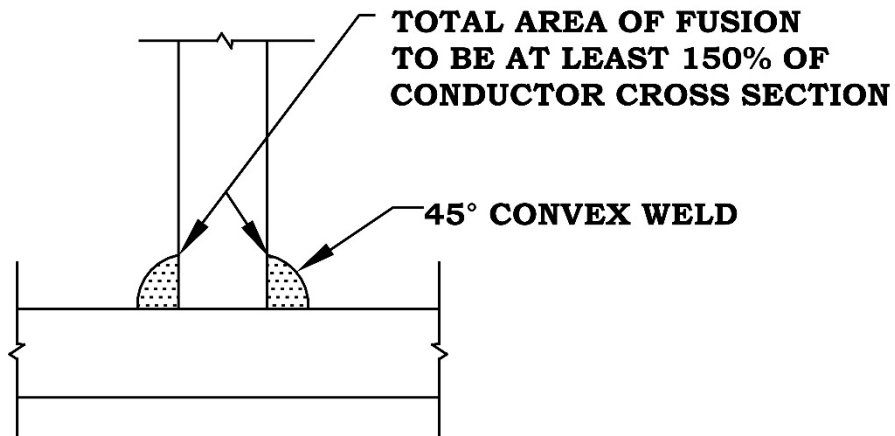
5. WORKMANSHIP

- A. Welding shall be performed by skilled welders, who are certified in their profession. All welds shall be made with clean metal and the finished weld shall be free of pores. The contour of all welds shall have a smooth finish and shall indicate good fusion with the parent metal. The area of fusion of the weld shall be at least 150% of the conductor cross section.
- B. All welded surfaces shall be wire brushed or filed to remove surface irregularities that may affect the corona suppressing properties of the weldment.
- C. Weld beads shall be in accordance with the applicable figure as shown.

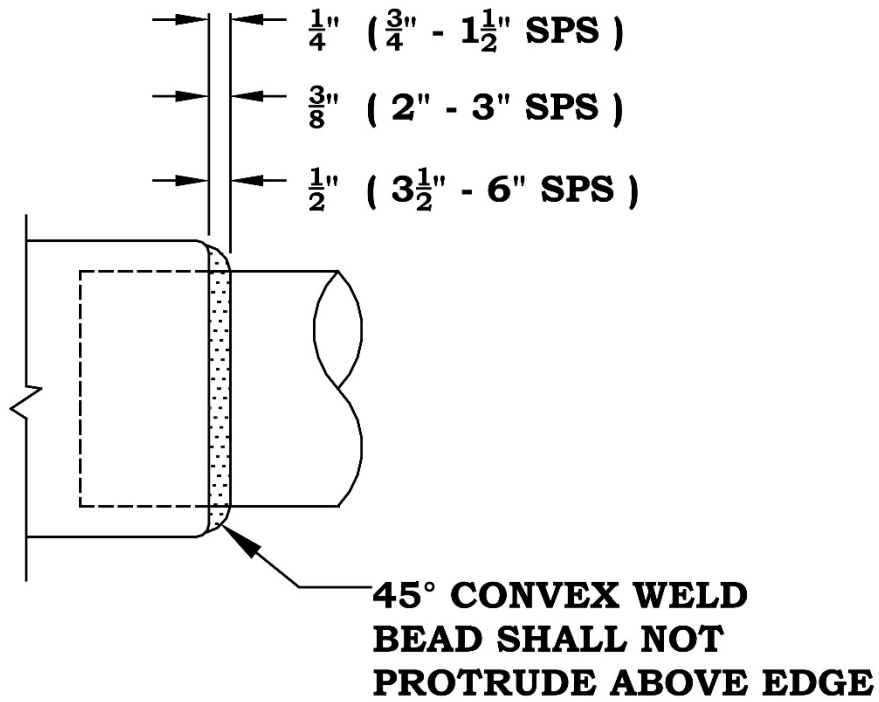
1. Puddle Welds



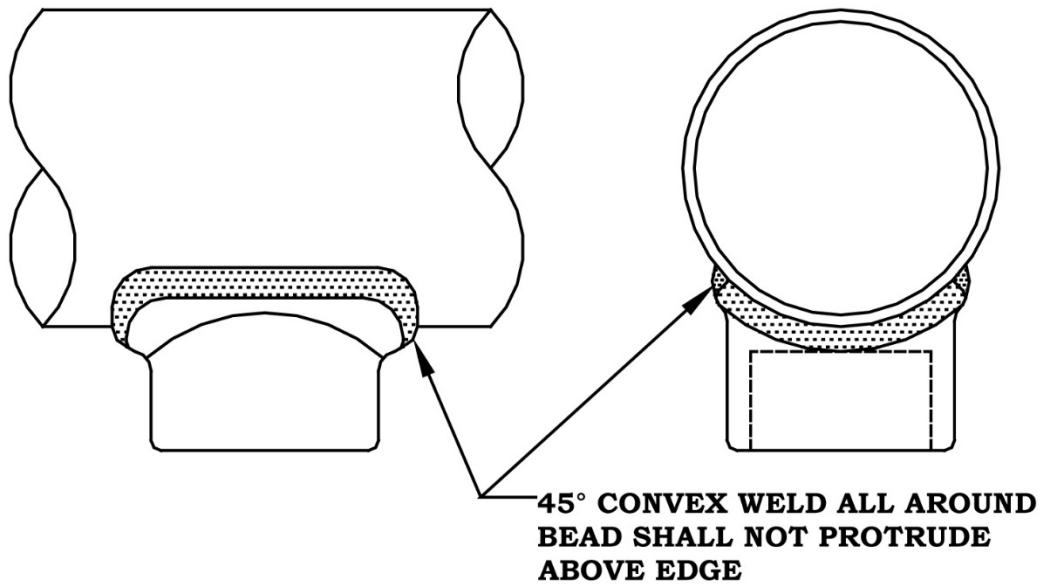
2. Butt Welds



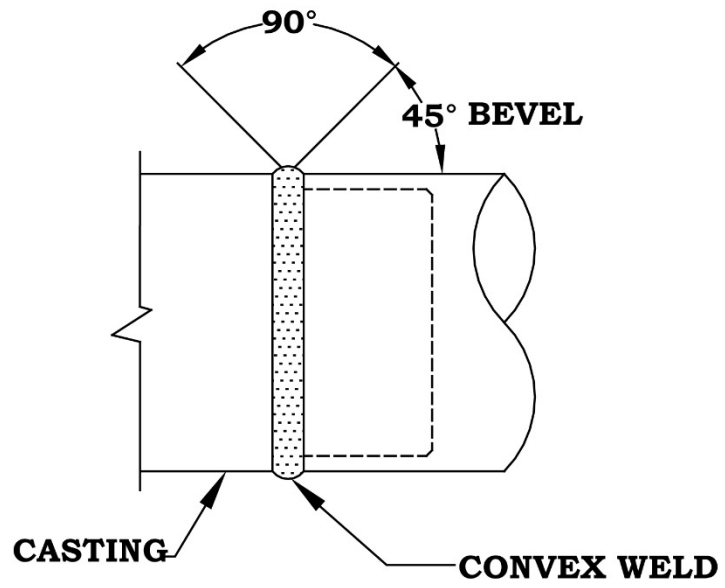
3. Socket Type



4. Saddle Type



5. Insert Type



BONDED COPPER FACE PLATE INSTALLATION

NOTE: The following procedures shall be strictly adhered to for bonding copper face plates to aluminum castings.

1. Aluminum solder (HI-Alloy #155) or equivalent shall be used. Solder should have a melting point of 700 degrees Fahrenheit to 750 degrees Fahrenheit.
2. Surfaces to be soldered shall be clean and flat with no holes. Copper plates to be 1/16 inch thick, and of a size equal to that of the aluminum surface.
3. Both parts (aluminum and copper) shall be brought to a temperature sufficient to melt the solder, but not to exceed 900 degrees Fahrenheit. A generous coating of solder shall be applied to both surfaces, "brushed in" with a clean stainless steel wire brush to remove all possible oxidation, then a second coating of solder is to be applied to both surfaces. With both parts still at a temperature sufficient to maintain solder in a liquid state, heat is to be removed, parts mated and aligned (solder to solder) and clamped together with an even pressure and allowed to cool to room temperature.
4. Casting with a bonded copper plate shall be then cleaned, ground, drilled and inspected to insure no cracks are visible between the copper and the aluminum.

SPECIFICATIONS FOR ALUMINUM SAND CASTINGS

ALLOY 356

DESIGNATION: ASTM B26/B26M-12, ANSI 356.0, UNS A03560

Composition, physical properties, manufacture, testing, workmanship, finish and inspection shall be in accordance with the latest revision of the above specification. Exceptions to these specifications are listed below.

In these specifications the term MANUFACTURER refers to the foundry, the term PURCHASER refers to SEFCOR, Inc., and the term INSPECTOR refers to a SEFCOR, Inc. inspector or other authorized representative.

Reasons for rejection, as referenced in ASTM B26/B26M-12 Section No. 20.1, include, but are not limited to, the following:

- Coarse grain structure
- Cold shuts
- Misruns
- Sand and slag holes
- Sand breaks which cannot be ground off or are in an objectionable location
- Any other defect which impairs the strength or usefulness of the casting
- Excessive porosity caused by gas

Exceptions to these specifications can be made only by agreement in writing between the manufacturer and SEFCOR, Inc. Purchasing Department after approval by Engineering.

HEAT TREATMENT SPECIFICATIONS

ALUMINUM SAND CASTINGS

ALLOY 356

The T-6 heat treatment shall be as follows:

1. Solution heat treat for twelve (12) hours at 975-985 degrees Fahrenheit. Rapid quench in water at 70-212 degrees Fahrenheit (Boiling water preferred). During heat treatment castings shall be so arranged in the oven that warping and buckling will be held to a minimum.
2. Precipitation heat treat for three (3) to five (5) hours at 305-315 degrees Fahrenheit, then cool at ambient temperature.

The T-51 heat treatment shall be as follows:

1. Precipitation heat treat for seven (7) to nine (9) hours at 453-445 degrees Fahrenheit, then cool at ambient temperature.

Deviation from these heat treatment specifications may be made by the supplier at their discretion as long as the following minimum properties are obtained:

For 356-T6:

Tensile strength - 30,000 psi
Yield strength (2% offset) - 20,000 psi
Elongation (2 inches) - 3%

SPECIFICATIONS FOR BRONZE SAND CASTINGS

ALLOY 85-5-5-5 (Cu-Sn-Pb-Zn)

DESIGNATION: ASTM B824-11, ASTM B584-13, UNS C83600

Composition, physical properties, manufacture, testing, workmanship, finish and inspection shall be in the above specification. Exceptions to these specifications are listed below.

In these specifications the term MANUFACTURER refers to the foundry, the term PURCHASER refers to SEFCOR, Inc., and the term INSPECTOR refers to a SEFCOR, Inc. inspector or other authorized representative.

Reasons for rejection, as referenced in ASTM 824-11 Section No. 16.1, include, but are not limited to, the following:

- Coarse grain structure
- Colt shuts
- Misruns
- Sand and slag holes
- Sand breaks which cannot be ground off or are in an objectionable location
- Any other defect which impairs the strength or usefulness of the casting

Casting properties shall meet the following minimum design values:

- Tensile strength - 30,000 psi
- Yield strength (0.5% yield) - 14,000 psi
- Elongation (2 inches) - 20%

Exceptions to these specifications can be made only by agreement in writing between the manufacturer and SEFCOR, Inc. Purchasing Department after approval by Engineering.

SPECIFICATIONS FOR ALUMINUM BRONZE SAND CASTINGS

ALLOY 89-1-10 (Cu-Al-Fe)

DESIGNATION: ASTM B824-11, ASTM B148, UNS C95300

Composition, physical properties, manufacture, testing, workmanship, finish and inspection shall be in the above specification. Exceptions to these specifications are listed below.

In these specifications the term MANUFACTURER refers to the foundry, and the term INSPECTOR refers to a SEFCOR, Inc. inspector or other authorized representative.

Reasons for rejection, as referenced in ASTM 824-11 Section No. 16.1, include, but are not limited to, the following:

- Coarse grain structure
- Colt shuts
- Misruns
- Sand and slag holes
- Sand breaks which cannot be ground off or are in an objectionable location
- Any other defect which impairs the strength or usefulness of the casting

Casting properties shall meet the following minimum design values:

- Tensile strength - 65,000 psi
- Yield strength (0.5% yield) - 25,000 psi
- Elongation (2 inches) - 20%

Exceptions to these specifications can be made only by agreement in writing between the manufacturer and SEFCOR, Inc. Purchasing Department after approval by Engineering.

SEFCOR Shop Traveler

<u>Puller</u>	<u>Part #</u>	<u>Job #</u>

<u>QTY Required</u>	<u>Ship Date</u>

	<u>Work Center</u>	<u>Pcs.</u>	<u>Operator</u>	<u>Date</u>
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

SEFCOR Inspection Guide

Product: All castings


Notes: General quality checkpoints for all castings

Checkpoints

1. All flash and the remains of gates and risers have been removed with sufficient care to restore the proper contours of the cast piece.
2. Unsightly marks from cutting wheels or other tools have been removed.
3. Conductor grooves have a smooth 1/8" radius.
4. Sharp edges introduced by gates and risers have a smooth 1/16" radius.
5. Grooves and sockets fit appropriate gauges
6. Cast holes have been re-drilled as necessary and fit appropriate check blocks.
7. Castings do not have any areas of metal shrinkage
8. Castings do not have gas holes

APPROVAL

This Quality Assurance Manual has been reviewed for completeness and found to accurately reflect SEFCOR, Inc.'s high quality standards. Any possible errors or omissions should be immediately brought to the attention of the appropriate SEFCOR, Inc. personnel for review.



Gene Helms
Quality Assurance Co-Director

4/3/14

Date



Doug Smith
Quality Assurance Co-Director

4/3/2014

Date