Honeywell

QA/QC

Manufacturing Procedures

for

Devices Containing Sources of Ionizing Radiation

July 1, 1996

Honeywell, Inc.
Industrial Automation & Control
Radiological Operations
1190 West Druid Hills Drive
Atlanta, GA 30329
404-248-2350

Purpose

The purpose of this document is to provide guidance to Honeywell manufacturing entities involved in the direct manufacturing or assembly of devices containing sources of ionizing radiation. These devices can represent a hazard to the user and/or public if not manufactured and assembled according to the exact specifications incorporated as part of the design. At no time will any device be manufactured or assembled that does not completely meet the design specifications.

Outside Suppliers

Many of the component parts utilized in the manufacture of devices containing sources of ionizing radiation are supplied by outside contractors either as individual parts, combinations of parts or assemblies. These outside contractors should be selected based on the quality of work performed in the manufacture of component parts. Cost should absolutely not be the deciding factor when selecting outside contractors.

It is preferable that more than one acceptable outside contractor be utilized for each component part or assembly, when possible. The use of multiple suppliers can help insure a steady supply of components and provides insurance in the event one of the suppliers ceases production or can not satisfy the quality control requirements of Honeywell. When multiple suppliers are utilized, production from each supplier should be compared to the production from the other suppliers. When one particular supplier does not have the same level of quality as another supplier, this information should be provided to the negligent supplier. Increased surveillance of the negligent supplier should continue until it is assured that the level of quality has increased to an acceptable level.

Machine Tolerances

Perhaps the most critical area to be concerned with in the manufacturing of devices containing sources of ionizing radiation is machine tolerances. Many of the component parts in these types of devices are moving parts with very close tolerances between the parts. Even a small error in the machining of these parts can cause the device shutter mechanism to malfunction, possibly resulting in a radiologically hazardous situation. Particular care must be taken to assure proper machine tolerances are observed during the manufacturing process. The tolerances of the components used to construct devices containing sources of ionizing radiation follow the DIN ISO 2768-m Standard. The tolerances used in the manufacture of devices are listed on the following table. All measurements are in millimeters.

All machined or cast part, whether metal or non-metal, will be tested on a random basis for compliance with specifications. The actual testing is actually more rigorous than is obvious due to the fact that the tolerances between moving and non-moving parts is so close. In many cases, if the parts are not within tolerance, they simply will not fit in place. However, testing by assembly alone is not sufficient. Actual specimens of parts should be selected on a random basis and physically measured for compliance with DIN ISO 2768-m.

Tolerances For Longitudinal Dimensions

Tolerance Class	Over 0.5 - 3	Over 3 - 6	Over 6 - 30	Over 30 - 120	Over 120 - 400	Over 400 - 1000	Over 1000 - 2000	Over 2000 - 4000
Small	± 0.05	± 0.05	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	-
Medium	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2
Large	± 0.15	± 0.2	± 0.5	± 0.8	± 1.2	± 2	± 3	± 4
Very Large	-	± 0.5	± 1	± 1.5	± 2.5	± 4	± 6	± 8

Tolerances For Circular Dimensions

Tolerance Class	Over 0.5 - 3	Over 3 - 6	Over 6
Small	± 0.2	± 0.5	± 1
Medium	± 0.2	± 0.5	± 1
Large	± 0.4	± 1	± 2
Very Large	± 0.4	± 1	± 2

Tolerances For Angles

Tolerance Class	⇒ 10	Over 10 - 50	Over 50 - 120	Over 120 - 400	Over 400
Small	± 1°	± 30'	± 20'	± 10'	± 5'
Medium	± 1°	± 30'	± 20'	± 10'	± 5'
Large	± 1 30'	± 1°	± 30'	± 15'	± 10'
Very Large	± 3°	± 2°	± 1°	± 30'	± 20'

Materials of Construction

Due to the fact that many of the component parts of devices containing sources of ionizing radiation act as radiation shielding, either directly or indirectly, the proper materials of construction for each component part is particularly important. Improper metals utilized in the construction can result in increased radiation levels, corrosion, decreased mechanical strength or component material incompatibility. An example of material incompatibility would be the use of silicone rubber sealants. When silicone rubber sealants cure, acetic acid is released which can cause significant corrosion of tungsten shielding by the formation of tungsten acetate. No silicone rubber sealants or adhesives are to be utilized in any device containing sources of ionizing radiation.

All component parts, regardless of whether manufactured by Honeywell or an outside contractor, will be tested on a random basis to assure correct materials of construction. Shielding components composed of a tungsten alloy will be checked for correct alloy and voids. This can easily be performed by a weight measurement. Stainless steel components will be checked to ascertain that stainless steel was utilized in the manufacture. Since the particular alloy of stainless steel is relatively unimportant, this test can be performed visually. Parts constructed of aluminum that are anodized will be checked visually to ascertain that the parts are indeed anodized, to protect against corrosion.

Final Device Evaluation

Each and every device assembled will be fully tested after assembly for proper function. Sampling of representative samples is not permitted - tests will be performed on 100% of all devices manufactured prior to leaving the assembly stage. After leaving the assembly stage, most devices not destined for spares storage will be sent to the system staging area where the entire system is evaluated and tuned. In most cases, the devices will be operated through hundreds of cycles while in this area, providing a further performance evaluation prior to distribution to customers.

In the event a devices fails to function properly due to mechanical problems caused by improper machine tolerances, the device will be thoroughly evaluated to determine the faulty component(s) and negligent supplier(s).

All devices distributed to customers are installed and commissioned by a Honeywell engineer. Immediately upon installation and power-up, the stray radiation fields surrounding each device at 5 cm, 30 cm and 100 cm from the nearest accessible surface will be measured and recorded. At no time will the stray radiation fields measured exceed the maximums listed in the manual entitled 'Field Service Radiation Safety Procedures for Honeywell Employees'. If a device is found to have stray radiation levels in excess of the maximums, the device will be immediately taken out of service and a Honeywell Radiation Safety Officer notified. Stray radiation tests will be performed on 100% of devices upon installation.