LEHIGH HEAVY FORGE
Precision Forgings to Shape the Future
A subsidiary of WHEMCO Holding Inc.

275 Emery St.
Bethlehem, PA 18015-1984
Phone: 610-332-8100
Fax: 610-332-8101

Lehigh Heavy Forge Corporation
Supplier Requirements for
Detrimental Material Control

1. PURPOSE

To assure that the finished surface of a "special purpose" forging (see definition below) is processed according to the contract requirements for detrimental material controls.

2. SCOPE

The guidelines are for complying with Lehigh Heavy Forge (LHF) customer's requirements that restrict the use of detrimental materials, ensuring that harmful contaminants do not remain on the surface or degrade the chemical, physical, or metallurgical properties of the forging.

3. DEFINITIONS

3.1 Special Purpose Forgings: are those corrosion resistant or non-corrosion resistant material forgings where detrimental materials are contractually prohibited from being present either at critical stages of manufacture or as a general prohibition during all stages of manufacture.

3.2 Corrosion Resistant Materials: are metals or alloys, which inherently resist oxidation or chemical attack in air or water at ambient temperatures. Examples of corrosion resistant materials are stainless steels, nickel-based and copper-based alloys, and precipitation-hardened steels.

3.3 Non-corrosion Resistant Materials: are steels, which inherently do not resist oxidation or chemical attack in air or water at ambient temperatures. Materials of this class include plain carbon and low alloy steels, etc.

3.4 Critical Stages of Manufacture: are determined by contractual requirements of the customers. These stages are:(1) prior to or during hot forming operations - for corrosion resistant material forgings only, (2) prior to heating of machined surfaces of corrosion resistant or non-corrosion resistant material forgings above 200 degrees F., and (3) following the production of final surfaces on corrosion resistant or non-corrosion resistant material forgings.

3.5 Detrimental Materials: are materials or consumables, which are knowingly or intentionally placed in contact with a forging during thermal treatment or transfer to a cleaned surface, and may have a harmful effect on the forging because they contain prohibited or restricted elements, which exceed the prescribed limits.

3.6 Acceptable Products: contain less than the detrimental material limits for both corrosion resistant and non-corrosion resistant material. Removal by an approved cleaning procedure is required for final surfaces as specified by the customer. Chemical analysis or product certification is required on acceptable products. Analysis and/or certification shall be obtained on each procurement, or once every three (3) years, whichever is less frequent.

3.7 Foreign Material: is shop debris from normal operations that should not be put upon or remain in contact with the forging.

3.8 Mercury Contamination Controls: apply during all stages of manufacture. Contact with mercury and mercury compounds, and consumable products or devices containing mercury in excess of 10 ppm, is prohibited. Lights containing mercury, such as mercury vapor, sodium vapor, and fluorescent lights shall have a secondary boundary or complete cover when used in such a manner that their breakage could contaminate the forging with mercury, and/or used within 20 feet (4 sides and above the forging).

3.9 Controlled Products: are shop materials or consumables, which meet the mercury contamination controls limits, but have not been analyzed or do not meet the other detrimental material limits for corrosion resistance and non-corrosion resistant materials. Use of these products requires planned removal by an approved cleaning procedure at critical stages of manufacture.

3.9 Thermal Treatment: is any operation where the temperature of the forging exceeds 200 degrees F. Metal removal, such as grinding, machining, filing, other than thermal cutting, is not a thermal treatment.

3.10 Final Surfaces: are those final machined surfaces of special purpose forgings that will be subject to no further metal removal operations.

3.11 Loose General Shop Debris: consists of those foreign materials which may be produced during machining. These items consist of dust, chips, etc. and may be removed by blowing with clean dry air, sweeping, brushing, wiping, or vacuuming of the forging surface.

4. RESPONSIBILITY

4.1 It is the responsibility of the subcontract machining source to control the use of approved materials that knowingly or intentionally come in contact with the forging during processing.

4.2 It is the responsibility of everyone involved in the manufacture of “special purpose” forgings to ensure that control of mercury is enforced, and contamination or potential contamination is reported to the LHF Quality Assurance department.

5. REQUIRMENTS

5.1 Unauthorized Items:

- Do not use any items which have not been previously approved.
- Do not re-use containers until they have been cleaned.
- Do not use files or other hand tools which may have been previously used on forgings with lower chemical requirements.
- Do not use any tools previously used on lead, or on materials containing lead compounds.
- Do not use any tools which may be cadmium or zinc plated.

5.2 Transfer of aluminum, copper, silver, or their alloys to final surfaces that may subsequently exceed 600° F shall be prohibited. For subcontract machining, consider that all final surfaces may subsequently exceed 600°F. Transfer is considered not to have occurred if final surfaces are verified to be visibly free of the metals or alloys.

5.3 Mercury controls are in effect every time a contract calls for any detrimental materials control requirements.

5.4 Exposure or potential exposure to mercury or its compounds through the normal use of materials, consumables or broken/damaged lighting must be reported to Lehigh Heavy Forge Quality Assurance immediately and the forging held from further processing. Possible sources of mercury:

- Chemical solutions
- Instrumentation such as thermometers and manometers
- Mercury vapor, sodium vapor, and fluorescent lights (overhead portable and drop lights)
    - These lights should have a secondary boundary or complete cover that when used in such a manner that their breakage could contaminate the hardware with mercury or used within 20 feet (4 sides and above) of the forging.
    - A secondary boundary or cover shall be such that if breakage takes place, no part of the lighting shall become free.
- No-bounce hammers
- Electrical switches and relays

5.5 The subcontract machining source may choose to maintain a summary report on the elemental content of mercury, low melting point metals, sulfur, phosphorous, halides, and boron as applicable or in the absence of discreet analysis a certification that mercury or the applicable detrimental materials are not present in the products beyond the allowable limits. In the alternative, the subcontract machining source may use materials in processing "special purpose" forgings that are analyzed and approved by Lehigh Heavy Forge. A listing of "NDT Couplants, Solvents, Other Liquids, Inspection and Marking Materials" analyzed for mercury, sulfur and phosphorous will be provided by Lehigh Heavy Forge upon subcontractor request.

5.6 Low melting point metals include antimony, arsenic, bismuth, cadmium, lead, magnesium, tin, and zinc, and are prohibited during thermal treatments of forgings with machined surfaces and on finished or cleaned surfaces of forgings offered for acceptance. In addition, phosphorous and sulfur in excess of specified limits are prohibited during thermal treatments, including heating and hot working, and on finished or cleaned surfaces of corrosion resistant material forgings.

- Halides include chloride, fluoride, and bromide.
- Boron may be required for materials contacting corrosion resistant special purpose forgings.
- Any elements exceeding allowed maximums will be highlighted on the report. Additional notation will identify excesses, which could affect corrosion-resistant materials.

5.7 Certifications of shop hand, assembly, and general shop tools and/or products are excluded when the tools and/or products are composed of acceptable materials. Acceptable materials include:

- Chrome plated steel
- Carbide tools
- Corrosion Resistant steel
- Nylon (natural/uncolored)
- Silicon carbide
- Nickel plated steel
- Hardened tool steel
- Aluminum oxide.

5.8 Cutting tools shall be visually clean (except for any appropriate machining coolant) and free of burrs, slivers, chips, shavings, etc., before use.

5.9 Contacts by liquids (other than water or snow), pastes, adhesives, and tapes are materials which are considered to transfer to a forging. These may be removed by an approved cleaning method if:

- Mercury contamination is not suspected.
- Neither the forging nor the contacting material was in excess of 200 degrees F.
- Following removal and visual inspection, there is no evidence of harmful effects.

5.10 The cleaning of all hardware surfaces (both internal and external) shall be cleaned with a solvent or water conforming to Table I requirements.

TABLE I. Cleaning Solvents

Solvent	Specification	Note
Acetone	**ASTM D 329**	**Unused or Redistilled**
Denatured Alcohol	**27-CFR-21**	**Denatured ethanol according to formula 3-C, 23-A or 30**
Isopropyl Alcohol	**TT-I-735**	**No note**
NOTE: American Chemical Society reagent grade solvents meeting the purity requirements of the above specifications may also be used.		

NOTE: All forgings will be returned to LHF after subcontractor machining for final NDT and dimensional inspection and certification. After final inspection at LHF, all forgings are cleaned in accordance with an approved cleaning procedure before shipment.

6. SUMMARY OF CHANGE

6.1 Original issue of the "Requirements for Detrimental Material Control". (Rev. 0)

6.2 Content changes are noted in bold. (Rev. 1)

6.3 Additions of: a) added revision history, b) added statement concerning transfer of aluminum, copper, silver, and their alloys. (Rev. 1)

6.4 Format changes. Addition of: a) cutting tool cleanliness requirement, b) surface cleaning materials requirement. (Rev. 2)