



2169 North 100 East - Warsaw, Indiana 46582 - (574)269-7116 - Fax (574)269-7906

Requirements for Flowdown

Purchase order (P.O.) Information Flowdown Requirements for Heat Treatment



Vacuum Heat Treating & Brazing



Applied Thermal Technology

Part I: Required Purchase Order (P.O.) Information Flowdown for Heat Treatment.

Note: Guidelines for Sections A, B & C listings are in Part II.

Section A: Always Required Information:

1a. Purchase Order Number b. Date	6a. Part Number b. Part Name or c. Product Form
2a. Purchase Order Originator Name b. Address	7. Quantity of Each Item
3a. Name of Prime (if known)	8. Material / Alloy Designation or Specification
4a. P.O. Originator b. Contact Person (if different) c. Method of Contact	9. Present Condition 10a. Heat Treat Specification b. Revision
5a. Heat Treat Supplier Name b. Address	11. Heat Treat Requirement

Section B: State Operations that the Heat Transfer is not required to Perform. These operations, required by specifications, have either been performed prior to shipment to the Heat Transfer, or will be performed by the Customer, or a Third Party after processing by the Heat Treater.

12. Pre Heat Treat Cleaning/Processing	14. Other Post Heat Treat Testing
13. Final Hardness/Conductivity Testing	15. Post Heat Treat Cleaning/Processing



Section C: Required Information, When Applicable:

16. Due Date	26. Test Methods & Specimens
17. Prior Processing	
	27a. Hardness/Conductivity Test Sampling b. Other Test Sampling
18a. Special Furnace Atmospheres b. Surface Condition	28a. Hardness Test Location b. Other Test Location
19. Special Engineering Instructions	29a. Dimensional/Tolerance Requirements b. Measuring Methods
20. Frozen (Fixed) Process	30. Post Heat Treat Processing
21. Exceptions to Requirements	31. Special Packaging and Shipping
22. Serialization	32. Shipping Location
23. Fixturing or Tooling	33. Certificate/Test Report Exceptions
24. Racking Instructions	34. Special Documentation
25a. Surface Hardening Requirements b. Testing Methods c. Stock Removal	35. Model of Craft (if known)



Part II: Guidelines for Purchase Order (P.O.) Information Flowdown for Heat Treatment

A. Description of Minimum Required Purchase Order Information in Part I, Section A:

1. **Purchase Order Number, Date:** The purchase order shall have a unique number that has been assigned to this specific shipment and shall be dated. Any revisions or amendments to the purchase order shall also have a unique identity, such as a revision letter or a revision date as part of the purchase order number. Either the purchase order shall accompany the parts, or the paper work accompanying the parts shall have all the details required.
2. **Purchase Order Originator Info:** Complete mailing and shipping addresses are necessary.
3. **Name of Prime:** Obtain it from the drawings and specifications, or your customer's purchase order. In some cases this information is essential for proper processing.
4. **Purchase Order Originator Contact:** Include the phone number, cell phone number, fax number, title, and/or the e-mail address of the person or persons to be contacted for purchase order and/or technical questions.
5. **Heat Treat Supplier Info:** It is the responsibility of the company issuing the purchase order to verify that the heat treat supplier has been approved by the purchase order originator, their customer, or has a current approval from the prime contractor.
6. **Part I.D.:** Each item on the purchase order shall be uniquely identified. Depending on the product form and customer requirements this may be either by part number; part number /serial number or dimensional description. When the product form is required to ensure that the correct heat treatment parameters can be selected this shall also be included on the purchase order, e.g. sheet or plate.
7. **Quantity:** Each unique item shall be quantified, including test samples.
8. **Material/Alloy Designation or Specification:** Use standard alloy designations, such as 7075 Aluminium, 4130 alloy steel, 304L stainless steel or AMS. Aluminium sheet shall be listed as clad or bare. Trade names or generic material designations can be misleading and are not accurate. **Example:** Air harden tool steel, low carbon steel, 7000 series, chrome-moly and 300 series cover many different alloys with different heat treat requirements.



- 9. Present Condition:** Identification of the purchased material condition must be clear.
Example: Normalized, ½ H, solution treated and cold worked/stretched, stress relieved, etc. **Important:** Any processing performed after purchasing the material shall be noted clearly. Operations incorporated for manufacturing purposes can have a significant affect on the properties of the material after heat treat. **Example:** Hot forming, bending, in-process stress relieving, welding etc. In some cases, additional heat treat operations may be required to bring the material to the original purchase condition. In extreme cases, authorization may need to be obtained.
- 10. Heat Treat Specification Info:** All heat treating specifications and their current revision shall be listed on the purchase order. If the revision letters or dates are not available to the buyer and they are not required by the end user/Prime to be listed by the ultimate customer, then a statement to use the latest revision shall be included on the purchase order. Specifications that are listed in the applicable documents section of the heat treating specification do not need to be listed, but associated specifications for cleaning, testing, etc. listed on or embedded in the engineering drawing (Blueprint) or other engineering documentation that are not referenced in the heat treating specifications shall be listed on the purchase order. Many specifications on Blueprints have been superseded by specifications with different requirements than the original. If an obsolete or non-current specification is still required, the specification number, revision, and date must be stated clearly on the purchase order.
- 11. Heat Treat Requirement:** A specific description of the heat treat processing requirement as described on the purchase requisition, the shop paperwork or the engineering drawing (Blueprint) and the revision letter shall be clearly stated on the purchase order. Processes for non engineering drawing (Blueprint) operations or in-process heat treatments must be clearly and unambiguously stated as such. Reference to an engineering drawing (Blueprint) note is acceptable provided the applicable drawing is available. If a specification is called out on the purchase requisition, shop paper or engineering drawing, the specific temperatures, times and other processing details do not need to be on the purchase order. If the temperature, times, or other processing details are specifically called out on the purchasing requisition, shop paper or the engineering drawing (Blueprint), shall be provided or the verbiage shall be on the purchase order verbatim. If they are specifically called out on the purchase requisition, shop paperwork or engineering drawing (Blueprint) they must be provided with the purchase order or the verbiage shall be on the purchase order verbatim.



B. Description of Required Purchase Order Information in Part I, Section B if Purchase Order Originator or a Third Party is Performing Required Processing and/or Testing.

- 12. Pre Heat Treat Cleaning/Processing:** If the Purchase Order Originator or a third party has performed the required cleaning, plating, passivation, or any other processing it shall be so stated on the purchase order. Of course the heat treat supplier will examine the parts for cleanliness and clean or re-clean as necessary, but will also have to perform any steps required by specification unless otherwise directed by purchase order.
- 13. Final Hardness and/or Conductivity Inspection:** If hardness and/or conductivity testing as required by the heat treat inspection, 100% or otherwise, is to be performed by a facility other than the heat treat source, it must be in writing. This may be via a written waiver separate from the purchasing order, or on the purchase order clearly stating the exception. **Example:** Checking of test coupons, test pieces, reduced sampling allowances, etc. in lieu of 100% testing must be unambiguously stated on the purchase order.
- 14. Other Post Heat Treat Testing:** Purchase orders need to have a statement which clearly identifies the test required by the heat treater which are referenced in the process specifications. This statement may be written to either specify only the tests required or list the tests not required. **Example:** Perform hardness testing only, hardness and tensile testing only, process per XXX-XXXX except tensile, metallography, and magnetic particle inspection not required. If test samples were provided and are to be returned untested this shall be so stated. Only those tests which are performed shall be so stated on the heat treat supplier's certification/test report. **Comment:** There is still a lot of aerospace heat treating being performed to AMS specifications. They contain more information related to product testing than heat treatments. In these cases it seems to me that having a purchase order specifying those not required. **Example:** "hardness testing only", "hardness and conductivity testing only", etc.
- 15. Post Heat Treating Cleaning/Processing:** If the Purchase Order Originator or a third party will perform the specification required post heat treatment cleaning, stripping, passivation, or any other processing it shall be so stated on the purchase order. Otherwise, the heat treat supplier is required to perform all processes stated in the specification unless the Purchase Order Originator directs them not to. The certifications will be stated likewise.



C. Description of Additional Information in Part I, Section C, When Applicable.

- 16. Due Date:** A due date that has been agreed upon by the heat treat supplier shall be listed on the purchase order. **Note:** If the heat treat supplier's receiving inspection discovers extenuating circumstances, such as count problems, re-cleaning, etc. the due date may need to be renegotiated.
- 17. Prior Processing:** If the material has had working/forming operations, or has had out of sequence processing, or had any rework or repair operations that could affect the outcome of the heat treatment, the purchase order should document this.
- 18. Surface Condition:** Information shall be provided regarding any finish machined surfaces or surfaces with minimal amounts of metal removal after heat treatment. **Example:** Alloy steels require special furnace atmospheres if less than 0.020 in. is removed from any surface after heat treatment. If surface condition, decarburization, or special furnace atmosphere requirements are stated on the engineering drawing (Blueprint) or other documentation they shall be specified on the purchase order.
- 19. Special Instructions:** Any special instructions from the drawing, shop paper, rework/repair, instructions or any other documents shall be submitted with the purchase order and referred to therein or shall be quoted verbatim on the purchase order.
- 20. Frozen Process:** Any fixed process shall have the Frozen Process No., revision and date stated on the purchase order. If the heat treat supplier is new or the frozen process approved document has been revised, a copy with the proper approvals shall be included with the purchase order.
- 21. Other Exceptions:** Any other exceptions to the specification requirements or to any other requirements submitted via the purchase order such as the engineering drawing (Blueprint) or shop paperwork shall be stated on the purchase order.
- 22. Serialization:** These shall be detailed on the purchase order, and maintaining it shall be compatible with a heat treat process.
- 23. Tooling:** Heat treat fixtures and any inspection tools shall be stated on the purchase order. Their identity and revision, if applicable, shall be stated. If they are shipped with the parts they shall be identified. If they are to be returned, it shall be stated. Special instructions for use of the fixtures and tools shall be included.
- 24. Racking:** Only when there are specific engineering racking requirements shall they be specified. Otherwise the specifications and the heat treat supplier's experience will determine how to rack, orient, and space the hardware.



- 25. Surface Hardening:** All Engineering Drawing (Blueprint) requirements shall be specified. However, the case depth shall take into account subsequent stock removal. If specific test methods are required they need to be stated on the purchase order. Test samples provided shall be representative of the parts. The method of verifying depth should be stated.
- 26. Testing Methods and Specimens:** All test samples (specimens, bars, extra parts, coupons, etc.) provided shall be listed on the purchase order along with their description, quantities, dimensions, test purpose and test requirements. If by prior agreement the heat treat supplier is to provide the test specimens, this shall be stated on the purchase order. Some tests, such as low alloy steel decarburization, normally have the specimens supplied by the heat treat supplier, but if more than one heat treat supplier gets involved, as for rework, etc, the original test samples may be required. **Note:** The necessary specimens and tests may be required by engineering drawings, specifications, shop paperwork, or rework/repair instructions, etc. In many cases it must be from the same heat of raw material and have seen the same prior heat treat processing as the parts or may be required to be oriented in a certain grain direction; all of this must be taken into account. Any special tests required by other than the specification must be accounted for in the purchase order requirements.
- 27. Hardness Conductivity Testing:** Shall conform to the requirements of the referenced specification. Some require 100% of the parts to be tested. However, sampling may be permitted by specification, or sometimes allowed with cognizant engineering and/or quality approval. Any deviations from the specification listed testing requirements must be stated on the purchase order and the sampling requirements stated. Also, see item **13**.
- 28. Test Location:** If inspection locations are specified or required for hardness or any other test, this shall be specified on the purchase order, drawing or other documents. If tests in certain locations are detrimental to the fit, finish or function of a part (i.e. bearing surfaces, etc.), such detrimental locations shall also be stated.
- 29. Dimensions:** Any required dimensions and tolerances shall be specifically stated. The method of checking the dimensions and tolerances for compliance shall be stated on the purchase order. The terminology of the requirements shall be compatible with the requirements. **Example:** Straightness vs. TIR. The verbiage must reflect quantitative planning requirements, avoiding vague statements such as "hold as straight as possible".
- 30. Post Heat Treat Processing:** The purchase order shall specify any post heat treating process that the heat treater is to perform which are not required by the specification. These might include blasting, chemical cleaning, stripping, straightening, NDT, etc. Any specifications required for these processes shall be denoted.



- 31. Special Packaging and Shipping:** Any special packaging, handling, preservation, or shipping requirements shall be stated on the purchase order. Otherwise the parts will be returned in the packaging they were received in.
- 32. Shipping Location:** If different from the address on the purchase order, the "Ship-To" location shall be stated on the purchase order.
- 33. Certificate/Test Report Exceptions:** Any additional information to be certified over and above the specification required certification or test reporting requirement shall be stated on the purchase order.
- 34. Special Documentation:** Any additional documentation, such as stamped-off routing sheets, furnace charts, in-process test results (such as quenched hardness), furnace numbers, processing data, etc. shall be specified on the purchase order.
- 35. Model of Craft (If known):** In some cases specification deviations and/or processing options can vary by model and some primes require this information to be listed on the purchase order.