



Department Owner: Engineering	 WELLINGTON Industries
Title: Die Standards	Document #: OWI-022 Rev Level: 3.0

These standards are an integral part of Wellington Industries contract for the design, construction, and / or purchase of dies. Acceptance of the purchase order indicates acceptance to these standards.

These Standards are not intended to be ALL inclusive but are to be used as a guideline for the design and building of tools for Wellington Industries

The tool design and build will be checked to these standards by both the vendor and a Wellington representative before the delivery of the tool. A copy of the signed Tool and Equipment Acceptance form must be presented with the invoice before payment can be made.

No tool will be accepted that does not meet or exceed this standard without written approval. Any deviations from this standard must be approved in writing by the appropriate Wellington Industries representative.


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WELLINGTON INDUSTRIES

DIE STANDARDS

SECTION # 1 -- DIE DESIGN

- 1) All dies that are designed for Wellington Industries, whether they are drawn manually or electronically, must consist of the following: Wellington stock list, index, Plan of Punch, Plan of Die, section A-A (through the entire length of the die showing each station's major function), section views as required through each of the stations to show necessary relationships and dimensions, and a strip layout or view of process step. Transfer Die Designs must also include views showing the Transfer Path / Cycle.
- 2) These drawings / Cad Files are the property of Wellington Industries. These drawings / Cad Files are to be shipped to the Engineering Department upon shipment of the dies. DWG files are the preferred method.
- 3) The Plan of Punch, Plan of Die, and strip layout must be drawn to full scale.
- 4) Any special punches, buttons or other details that are not standard order items must be 100% detailed and included in the drawing package.
- 5) All strip layouts will be reviewed and approved by Wellington Industries prior to any designs being started. The approval must be in a written format using the Strip Layout Review Form. If a vendor begins design work based on a verbal approval, the vendor will do so at their own risk.
- 6) All final designs are to be reviewed and approved by Wellington Industries prior to any construction. This will be done at 50% and 100% using a 50% and 100% Final Design/ Concept Approval Form that will be supplied by Wellington Industries. This design approval only constitutes a concurrence in the general design, layout, or function. Design approval does not constitute approval of design details, or adequacy of the tool to perform to the required specifications.
- 7) The responsibility for the adequacy of such design, strength and durability of the components, and the ability to achieve performance in accordance with the requirements, remains solely with the vendor.


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- 8) All die designs will reflect the part requirements as they pertain to GD&T datum schemes wherever possible.
- 9) "Oil Breaker Dimples" may be needed for thin Blanks / Parts for separation.
- 10) Blanks may need to be Nested / Orientated depending on the next operation.
- 11) Burr Direction may need to be verified per the print
- 12) Any translations of Wellington supplied math data will be the responsibility of the vendor. Wellington supplied math data or hard copy prints will be the master.


SECTION #2 -- DIE CONSTRUCTION

General Specifications

1. All tools to be built in US / English Standards.
2. All die sets for progressive dies must be 4 post minimum. All progressive dies will use bushings of the ball bearing type. Pins must engage a minimum of 75% of the length of the bushing before any other contact is made.
3. Max length for steel die sets is 120". Anything over 120" must be Cast Steel shoe. The Max Weight per lift is 40,000 lbs. Welded Die Sets are not allowed.
4. Cast Die Shoes need a Deck Thickness of 3" min under Form Areas, 2.5" min under Trimming Areas, 2" min Outer Wall Thickness and 1.5" min Inner Rib Thickness.
5. One guide pin must be offset on all dies.
6. Any die that has unbalanced forming or heavy side thrusts will utilize a boxed heel construction. This can be done in place of guide pins or in conjunction with guide pins.

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7. Lift Lugs are optional (see Parallels # 24) and if used are to be mounted to the Lower Dies Sets for ease of lifting (see figure 1). Casting Tools need to incorporate the Lift / Roll Over Lug (4 on upper and 4 on lower).
8. The die set will provide four handling holes in both the upper and lower die shoes. The holes are to be 1" tapped holes for dies that are less than 72" in length and 1.25" tapped holes for dies that are over 72".
9. Transfer Dies to be constructed to allow Automatic Transfer of each part from station to station by using Grippers.
10. Strip starting location is to be clearly marked in the die holder. Etching or grinding the lower steels is not acceptable.
11. When the Transfer Die is in the "Open" position, there must be at least 1" of clearance between the part and the die as it is presented to the Transfer Fingers.
12. Part Presence Sensors, Part Out Sensor and Cam Return Sensor must be used on all Transfer Dies.
13. Provisions must be made for a lot control stamp and a part number stamp. Also, in the case of a two- out die, the right and left hand must be stamped as such. Stamps are not to be stripper mounted. These stamps are to be located for easy access when the die is in the press. Use Argon stamp retainer MR-9 for both. Both stamps must allow for 11 digits. (Taper stencil)
14. Part Number, Customer, stock thickness, coil width, progression, shut height and weight should be stamped on the front or base of the lower die shoe.
15. A four digit Wellington part number, followed by the operation number, must be stencil painted white with oil-resistant, high-visibility paint on both the front and back of the upper die shoe. The upper die weight and the total die weight must also be stenciled on the die at least once. (Use 2" high stencils)
16. Line dies must incorporate features that would not allow further operations if an operation are skipped or incomplete. Locator pins and presence pins for holes should be used whenever possible instead of gage blocks.

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17. Dies are to be painted using RUSTOLEUM INDUSTRIAL ENAMEL. The Wellington Engineering Department will determine which color the tools are to be painted.
18. For each line die, the part must maintain consistent orientation as it is transferred through successive operations. The die process must not allow for rotation or part turnovers between operations. In the event that this is required, it must first be approved by Wellington Industries.
19. Provisions will be made for an ID stamp in all progressive dies and first form dies. The Wellington ID punch will be supplied and mounting will be the vendor's responsibility. Ownership of tooling must be permanently attached at the direction of Wellington Ind.
20. One part from every die is to be shipped when the dies are shipped.
21. Box heels for die shoes will utilize two wear plates. The lower die shoe will have a hardened wear plate and the upper shoe will have a Bronze wear plate.
22. Tool weight cannot exceed the crane capacity of the bay the tool is assigned to. Die sets will be split to accommodate the crane capacity and handling.

Parallels


23. All parallels are to be mounted to the die in such a way that they can be easily removed. Parallels should be mounted to the die set using no less than .625" screws. Welded construction will not be accepted.
24. Attachment slots on the shoes are to be on 6" centers. The attachment slots on the upper and lower must correspond with each other and be able to accommodate a 1" bolt. The thickness of the foot is to be 2" and must be a flat machined surface large enough to accommodate a 1" screw and standard washer. (see Figure 3)
25. Parallels are to be of sufficient strength and material that is proper for the use. Parallels should be placed appropriately to avoid any deflection of the die under load. Placement must take into consideration ease of scrap ejection. Scrap is carried out through the die to the back of the press with the use of a conveyor. The only exceptions are Press #119 and Press # 120 which have drop-thru openings for scrap.

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26. Press 118 must have a Free State Shut Height of 50" max; Press 119 must have a Free State Shut Height of 55" max. and Press 120 must have a Free State Shut Height of 55" max.
27. Centering Slots are to be machined in the Lower Parallels that are used for the Tie Downs. These Parallels must be doweled (see figure 4). Transfer Tools for Press #118, Press #119 and Press #120 use HMS style locators.
28. All dies must have slots or openings for easy pickup with a lift truck. Openings are to be a minimum of 2" x 7" for dies that weigh less than 10,000 lbs. and a minimum of 3" x 8" for dies that weigh over 10,000 lbs.
29. Transfer Dies must have a Master Plate on the Lower to assure proper alignment.
30. 2" wide Parallels may be extended out beyond the Shoe 6" with a 3" hole to accommodate a Chain Hook in place of the Lift Lugs (see figure 1b). Parallels over 9" must be reinforced or tied to adjacent parallel for Side Thrust during lifting.

Stock Guides / Lifters

31. Stock must feed smoothly through the entire die. Stock guides are to be hardened. One of the guides is to be stationary and the other is to be adjustable. The guide should be adjustable by +/- 0.200" from the mean width of the stock.
32. All Approach Rails need to have a "Tongue" over hang for ease of starting a coil. Approach Rails should be 9" min.
33. All Stock Guides need to have proper feed angles for ease of starting and moving coils through the tool.
34. Lifters and guides in soft sections are to be bronze bushed. Bar lifters are to be used where possible (see figures 5.1-5.4). All lifters and guides are to be hardened. Lifters need to be Poka-Yoke so they cannot be installed incorrectly.

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- 35. A min of 3 Standard Lifter Lock Downs is required for all Lifters and Pads.
- 36. All dies must have automatic ejection. The use of the coil feed in progressive dies to eject the part is not allowed.

Forms


- 37. All forming sections should be made from D2 material and hardened to RC 60-62. Form sections will use an atmospheric control - double draw Heat-treat process. Welding will not be accepted on any forming sections without written approval.
- 38. Critical Forms may be Laser Scanned by Wellington Industries. In these cases the forms must be approved in writing prior to the starting of the cut details.
- 39. Details that are subject to heavy thrust must be heeled or keyed.
- 40. Dies that have draw beads in a pressure pad must be inserted so that beads can be removed and shimmed while the die is in the press.
- 41. All flanging steels are to be made adjustable to accommodate varying material thickness. One sided flanging or forming is not recommended.
- 42. Forming Sections that are susceptible to wear and galling will be coated. The preferred coatings are Eifeler Lafer or Duplex. This will be reviewed at die design and at 'run-off' approval and 'run at rate'.

Cut Steels / Trims

- 43. Parts and scrap must fall free from the die. No air blow-offs are permitted. Scrap is to be deflected from the finished product to prevent scrap mixed with parts.
- 44. Parts should come off the end of the die with scrap falling through. Anything other than parts coming off the end Must be Approved by Wellington Engineering

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45. All cutting sections should be made from M2 material and hardened to RC 58-60. Cutting sections will use an atmospheric control triple draw heat treat process. Welding will not be accepted on any cutting sections. For Extreme High Strength material the cut steels need to be made out of Caldie and hardened to RC 54-56
46. Round or chamfer all non-functional sharp edges. (.06 R minimum)
47. Trim steels are to be 1.5" minimum.
48. All wire burned sections are to be split to have the ability to repair them on a surface grinder.
49. No section will have more than two locating dowels.
50. Blind dowel holes are not allowed. Dowels in all sections are to be slip fit. Dowels in die shoes to be press fit. Pull Dowels are required for all Dowels.
51. All details are to be stamped with the detail number and type of material. Detail numbers MUST match up with stock column number for same detail.
52. A minimum of two jackscrew holes will be provided for doweled sections.
53. Two extra details must be provided on stock pilots, punches, and buttons. An extra detail must be provided when any cross-section is less than .188" and foot mounted, inserted, etc. or detail is a special such as a form type button. All standard punches and buttons will be listed in the stock column.
54. Scrap cutters must be inserted. Maximum length for any length of scrap to be 8" or less.
55. Proper die clearances on all working steels are a must. No rolled edges, burrs or burnished trim lines will be accepted. Excessive scoring, pad marks, or recoil will not be accepted on any formed or flanged feature.
56. Die life on all trim sections to be a minimum of .50". Undercut should be minimal and have a 1/8" radius minimum in corners to prevent breaking. Sections must have counter bored holes to match the die life.
57. Perishable components must be removable with the die in the press.

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- 58. Backing plates must be hardened and at least 1/4" thick.
- 59. Die buttons are required for all pierced holes. Burning die button into a section is not accepted. Standard height for buttons is 15/16".
- 60. All buttons require a locking mechanism to prevent rotation during production.
- 61. Slugs are to be guided out of the die.
- 62. Cut-off and form sections are to have inserted cut steels.
- 63. Cut steels with form locators must have removable form locators for sharpening.
- 64. All punches are to be heavy-duty ball-lock, including pilots. For material that is greater than .187" shoulder type punches will be used. (If using shoulder punches, the stripper window must allow for removal of the retainer)
- 65. Gang retainers are not allowed unless absolutely necessary. This must be approved at the design stage.
- 66. All holes should be pierced to 20% under the high limit of the hole size, or .002" less than the high limit of the hole size; whichever is less.
- 67. All punches should have shedder pins; deviations need to be approved.
- 68. All punches and cutting steels will have shear where appropriate. (No knife edges)
- 69. All Adjoining trim lines between stations must have a By-Pass notch to eliminate shaving.

Pilots


- 70. Pilot clearance holes in the lower sections must be .010" larger than the pilot size. Pilot clearance holes must go completely through the detail and die shoe.

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71. When a specific hole(s) in a part is used as a tooling hole to locate the part in the die, the same hole(s) must be used in all stations/dies for proper gauging.
72. All pilots will be of the parabolic pointed type and will be of sufficient size for the application. Pilots must be mounted to the upper shoe.
73. Only tooling holes may be used to pilot a part. Re-piercing to a larger size when piloting is complete is allowed.
74. Progression must be maintained by the use of pilots.
75. Positive stops are to be Approved by Wellington for all progressive dies.

Strippers


76. Strippers are to be no less than 1.25" thick.
77. If a weldment type stripper is used, the welded sections must be bolted to the main portion of the stripper to prevent damage in case of weld failure.
78. Strippers and pads that weigh over 40 lbs. must have a 5/8" tapped handling holes for eye bolts.
79. Strippers must have an access window to provide for easy removal of components in the die during production.
80. Strippers or pads must be mounted using self-lubricating keeper blocks and guide plates. Spools will not be acceptable for strippers or pads unless prior approval is granted from Wellington.
81. Strippers and pads must be guarded around the entire periphery by Angle Iron or 1/8" sheet metal.
82. Nitro cylinders are preferred over springs in all cases. Preferred brands are Dadco, Hyson, or Standfast.
83. Die springs are not to exceed the manufacturer's suggested deflection for maximum life. Typically this is 75%-80% of total Travel.

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84. When springs are used they must be chrome vanadium. Wellington must approve the use of springs in any die and spring cages are to be used with all springs.
85. No Nitrogen or Springs are to make contact with the Ram.
86. Draw / Form Station Nitrogen Cylinders must be Plumbed.
87. When a nitro manifold is used, the recommended operating PSI must be stamped on the side of the manifold or on the nameplate.
88. A schematic of the nitro cylinder hook-up must be provided with the designs.
89. Self-contained cylinders are acceptable upon discussion of the application and approval from Wellington. If they are used, they must be easily accessible in the die during production.
90. If nitro manifold is used on the lower shoe, it is necessary to machine slots in the shoe at each cylinder to let oil and debris drain.
91. The location of the nitro charge unit must be in the front of the die and easily accessible during production.
92. No positive strippers without written approval by Wellington Industries

Cams

93. All cams are to have positive returns.
94. All cams over 6" must have a center locator "V" style key (see figure 7).
95. Preferred Dove Tail Gibbs for all cam slides (see figure 7).
96. Use self-lube type cams and slides whenever possible otherwise use grease fittings.
97. Cam drivers will have hardened wear plates and the cam slide unit will have a Bronze wear plate. Self-lubricating types are the preferred types. Wear plates must be accessible for shimming.


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Safety / Stop Blocks


98. Guards are required on all pinch points. Guards are to be painted yellow.
99. All dies will provide stop blocks to determine proper shut height. Stop blocks should be 2" x 4" and have a 1/2" wide groove .100" deep along the top of the stop block for lead checks.
100. Stop blocks should be mounted over parallels whenever possible and located to optimize operator safety and visibility. Stop blocks are to be located at least 1.5" away from any guide pins. Stop blocks are to be a one piece design.
101. All limit switches, nitro connections, air connections, etc. should have quick disconnect capabilities.
102. Adequate scrap and part chutes should be incorporated in all dies. They should be made to hinge out of the way for better die storage and should be contained within the confines of the die shoe.
103. Cams, springs, nitro items, air lines, stock guides, or any item that extends beyond the end of the die shoe must be guarded for operator safety and prevention of damage.

SECTION #3 -- GENERAL REQUIREMENTS


- 1) Acceptance of the Purchase Order will be acceptance of this package. Any work that is performed without a formal Purchase Order will be at the vendor's risk and Wellington cannot assume payment responsibility.
- 2) All tools will be accessible to Wellington follow-up personnel during the course of the build.
- 3) The vendor will be responsible to submit to Wellington Industries a Weekly progress report that details the progress of the tool build. The format for this will be supplied by Wellington and is due every Thursday. The forms should be faxed / e-mailed to the Program Manager.

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- 4) When Invoicing to Wellington, the appropriate Wellington Signed Approval Form must be included. The Forms that Wellington uses are the ‘Strip Layout Approval Form’, the “50% Die Design Approval Form”, the “100% Die Design Approval Form” and the “Die Build and Review Sign-Off Form”.
- 5) The Wellington Forms are filled out by the Tooling Engineer. The Vendor Must Request the Approved Signed Off form for each of the Tools that they are building. Transfer Dies are considered one tool.
- 6) The vendor will be responsible to request tryout stock from Wellington Industries using Wellington’s Request for Tryout Material Form. This form must be filled out with accurate information. If charges are incurred from inaccurate data, the vendor will be responsible for those charges. * A minimum of 8 weeks lead time is required to receive tryout steel at the vendor’s facility.
 - The quantity of tryout material requested should include enough material to complete any tryout as well as a 300 piece run-off.
 - Vendors should make all necessary attempts to order and run samples in coil form.
- 7) All requests for part changes, which address an improper tool condition or a potential production problem, must be addressed at the pre-award meeting.
- 8) At the time of the run-off at the vendor’s site, the vendor is to have six pieces fully laid-out and all dimensions documented. (CMM data is preferred)
- 9) The die run-off will consist of a 300 piece run under normal production parameters. The tool must not fail for any reason during that run. Any issues that arise during that run-off are to be corrected before shipping the die to Wellington.
- 10) Wellington will verify the dimensional integrity of the part to our customer’s specifications which includes a 100% laser scan of the part.
- 11) All tools must pass a Run@Rate which will be performed at Wellington Industries upon delivery of the tool.

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- 12) If the vendor has any ideas or suggestions to improve upon or change the basic design of the process, Wellington will have the appropriate personnel review those requests and work with the vendor for resolution.
- 13) Any equipment or measuring devices that is supplied to the vendor from Wellington (i.e.: check fixtures) is the responsibility of the vendor while they are at the vendor's site or in their use.
- 14) Dies will be expected to perform to meet all of the specifications that are on the print or math data.
- 15) All new tools are expected to perform a 1.67 PPK prior to being shipped.
- 16) All dies are expected to be delivered on time. Any costs that are incurred by Wellington because of a late delivery will be passed along to the vendor or the original amount of the Purchase Order will be debited. This may include additional layout costs, prototype costs, transportation costs, etc. Wellington may possibly debit the vendor 1% per Day late fee which would be deducted at time of payment.

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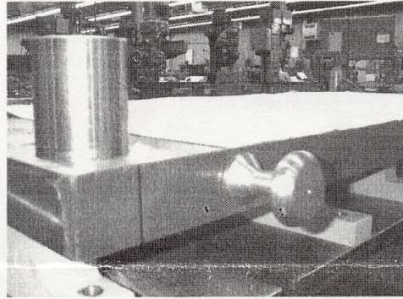
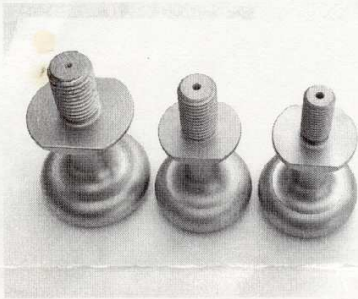
LIFT LUGS

J&C Tool & Die Limited is pleased to introduce you to their line of load-tested die lifting lugs. Several North American Tier 1 stamping operations have implemented these lugs.

ADVANTAGES:

- > Ease of handling
- > Solid one-piece construction
- > Able to be attached permanently
- > Sizes: 4 metric / 4 imperial

Quantities are produced to order. Custom sizes made to order.



PRICE SCHEDULE REVISED: August 17, 2001 All prices are in Canadian Dollars.

Models	Metric: M24-3 Imperial: 1"-8
Load Rating	8,000 lbs
Minimum Per Order	40
	Quantity Price Each
	40 \$82.50
	100 \$75.00
	200 \$73.50
	300 \$73.00
	400 \$72.75
	500 \$72.40


Models	Metric: M30-3.5 Imperial: 1.25"-7
Load Rating	9,000 lbs
Minimum Per Order	40
	Quantity Price Each
	40 \$124.00
	100 \$116.00
	200 \$112.50
	300 \$111.00
	400 \$110.00
	500 \$109.25

Models	Metric: M36-4 Imperial: 1.5"-6
Load Rating	13,000 lbs
Minimum Per Order	40
	Quantity Price Each
	40 \$124.00
	100 \$116.00
	200 \$112.50
	300 \$111.00
	400 \$110.00
	500 \$109.00

Models	Metric: M42-4.5 Imperial: 1.75"-5
Load Rating	13,000 lbs
Minimum Per Order	40
	Quantity Price Each
	40 \$132.00
	100 \$122.00
	200 \$120.00
	300 \$117.00
	400 \$115.00
	500 \$114.00

A-0003 Lift Lugs Information Sheet
Rev. 1

Figure 1

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Optional Parallel Design in place of Lift Lugs

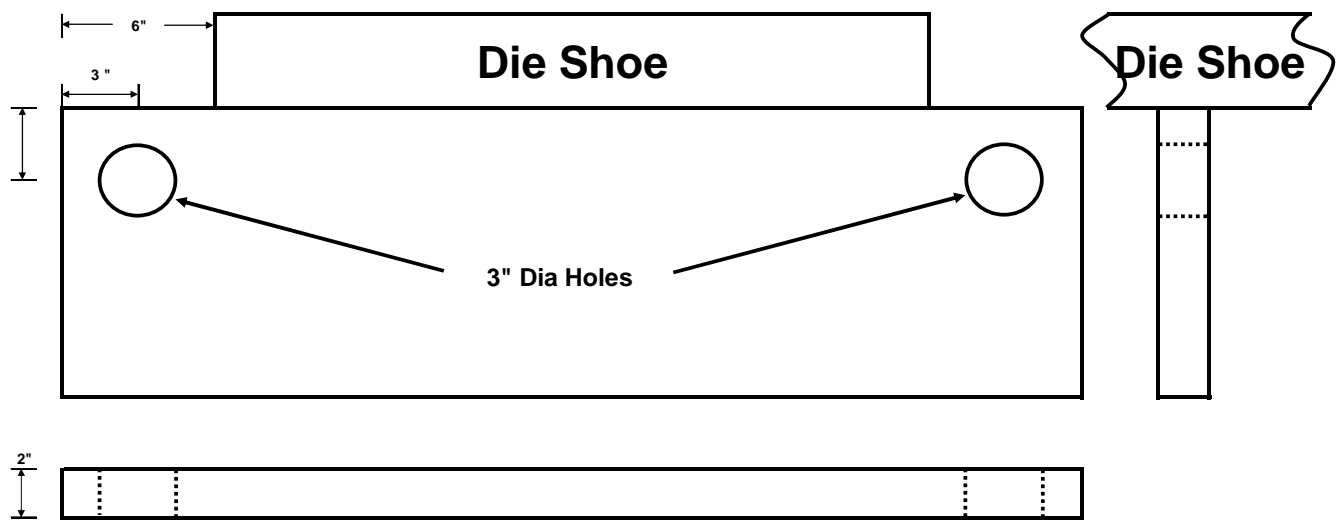



Figure 1b

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Wellington Industries Quick Die Change Feet

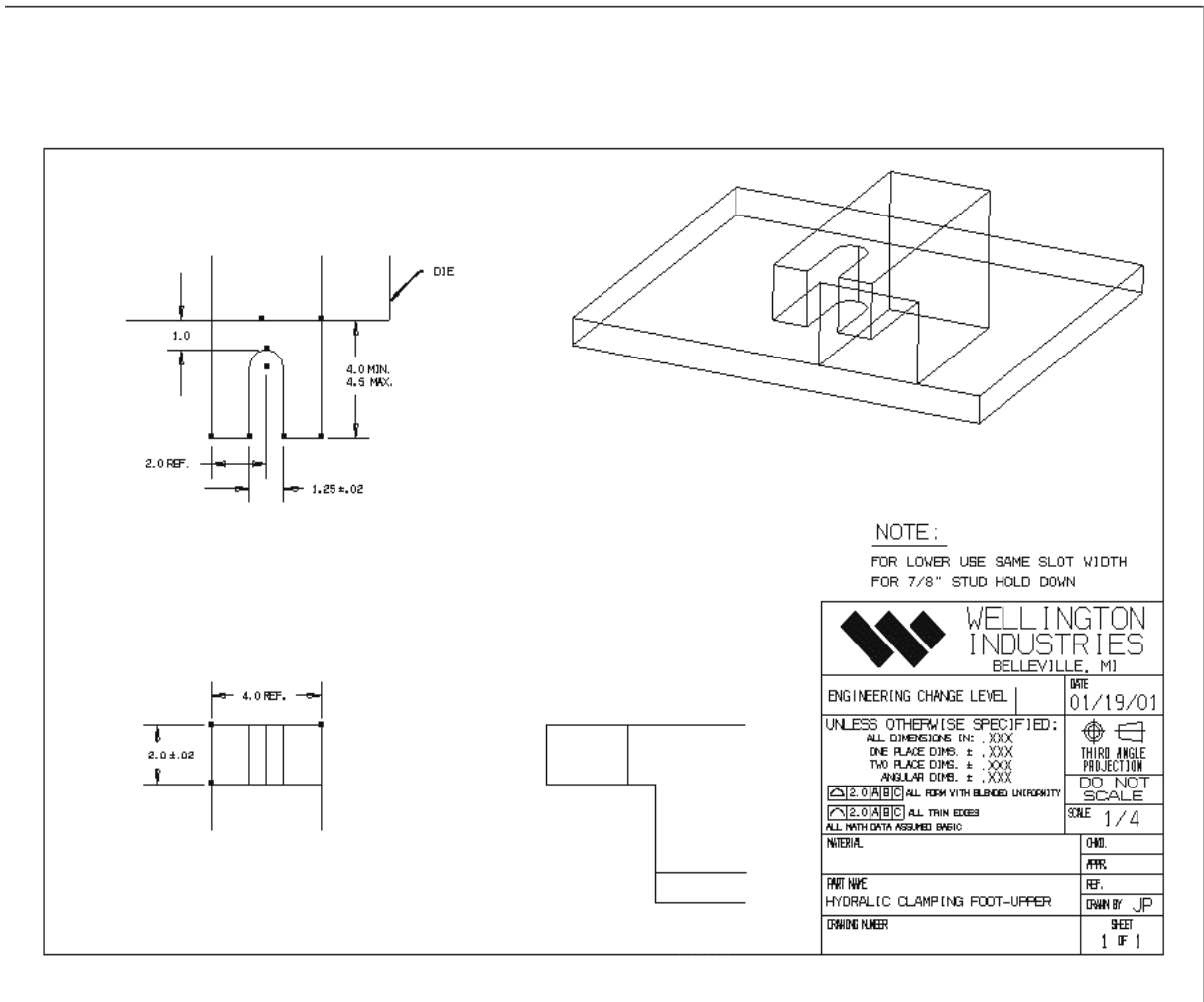



Figure 3

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Wellington Industries Die Centering Slot

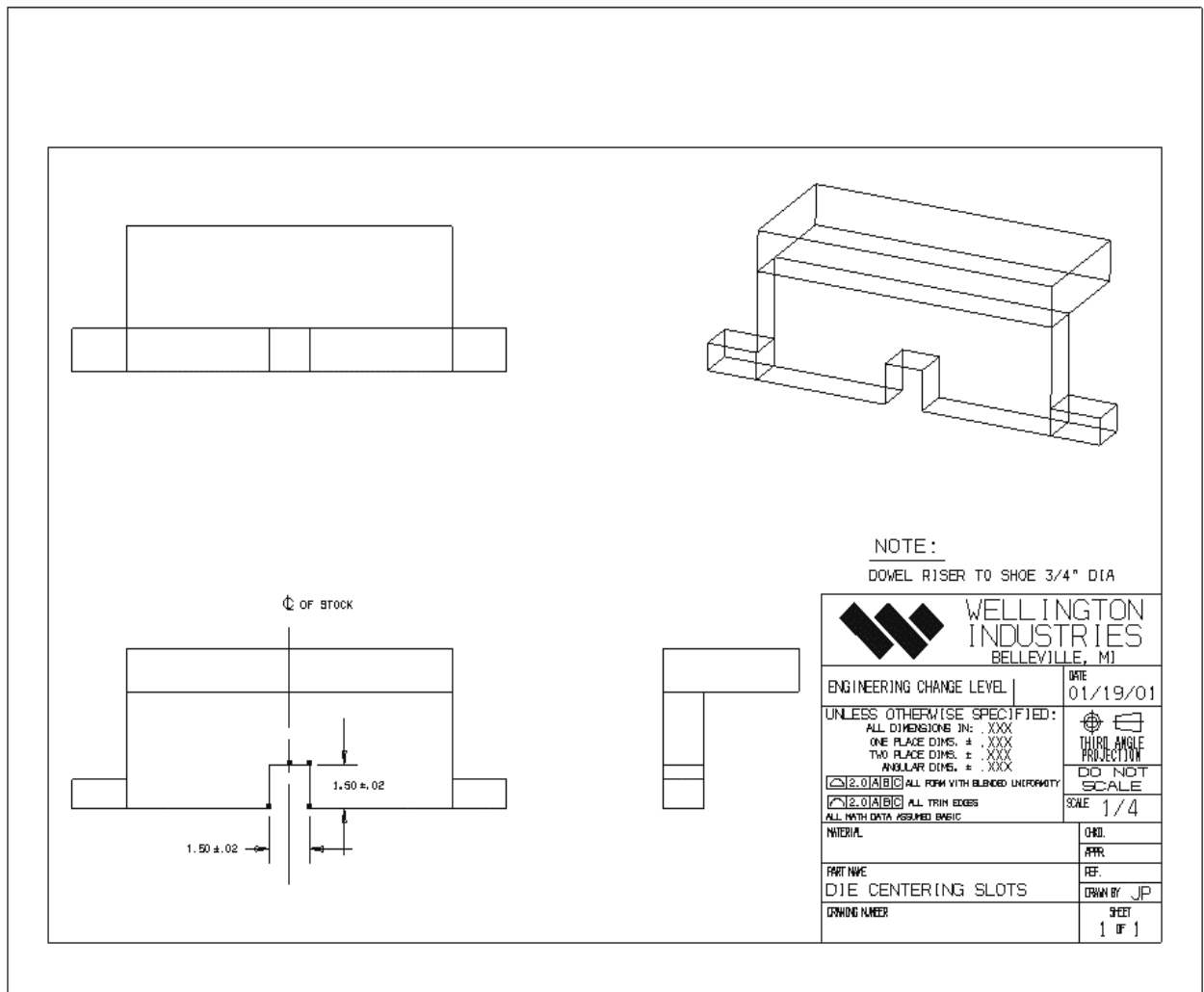

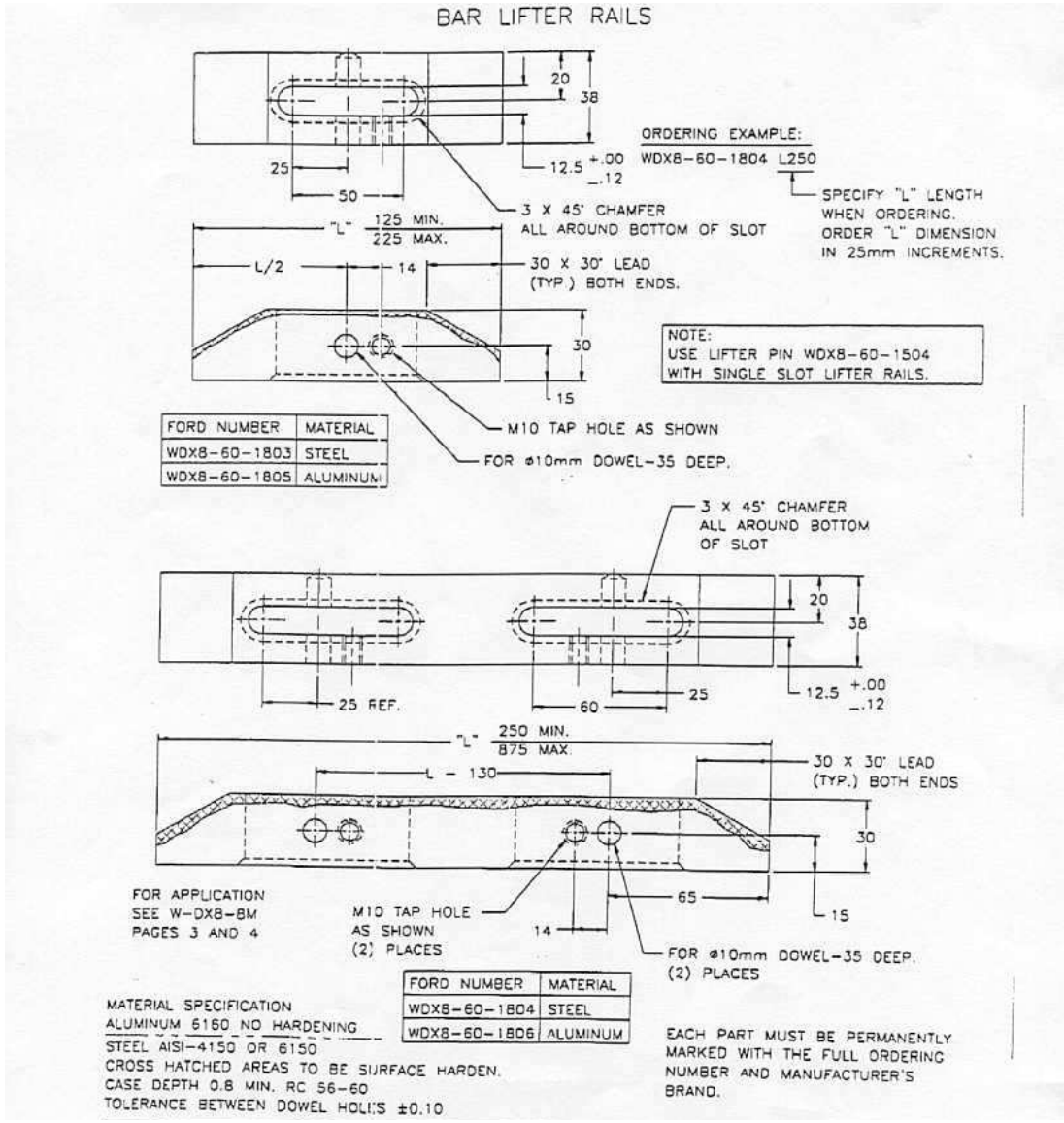



Figure 4

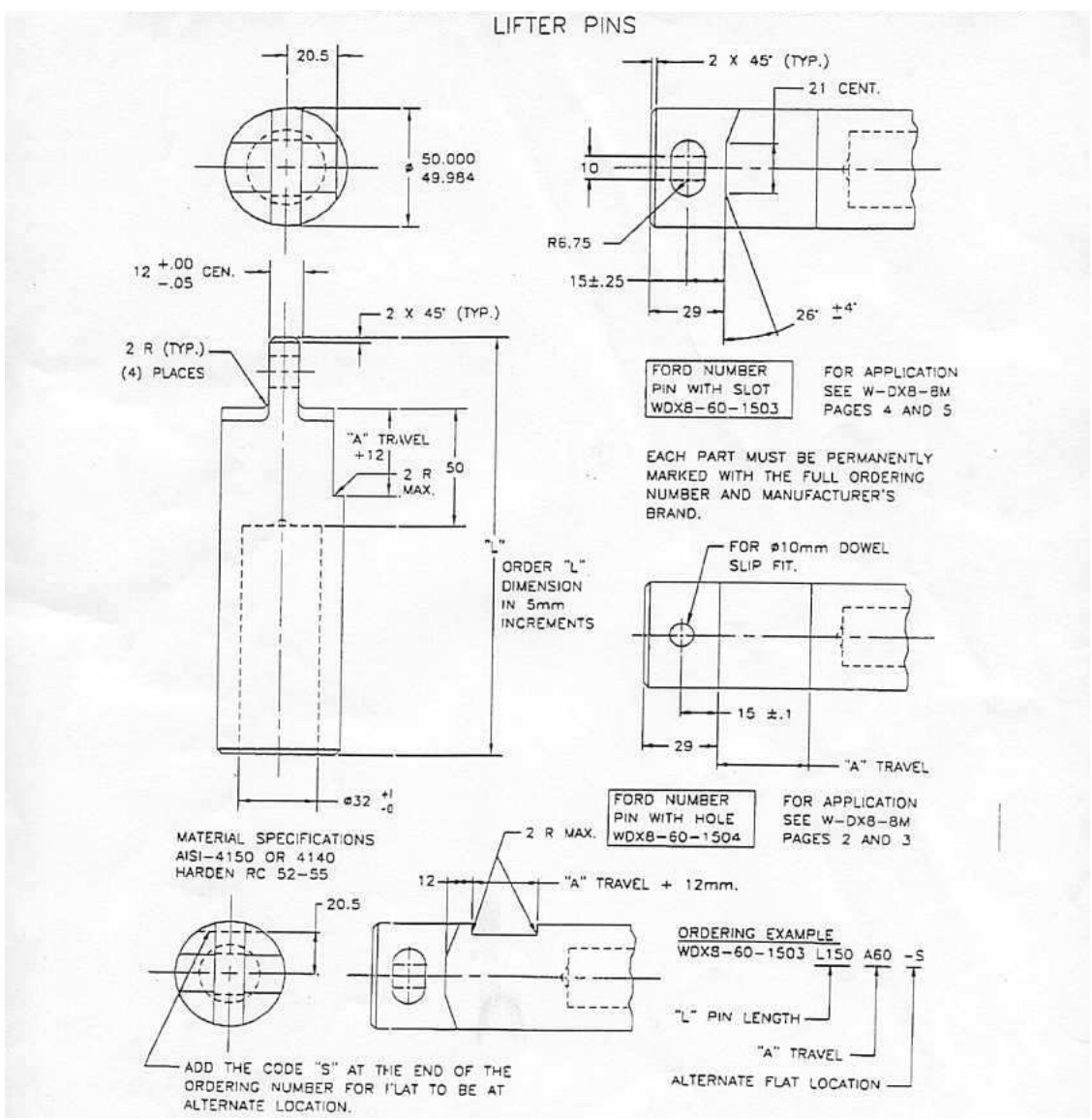
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Progressive Dies


Figure 5.1

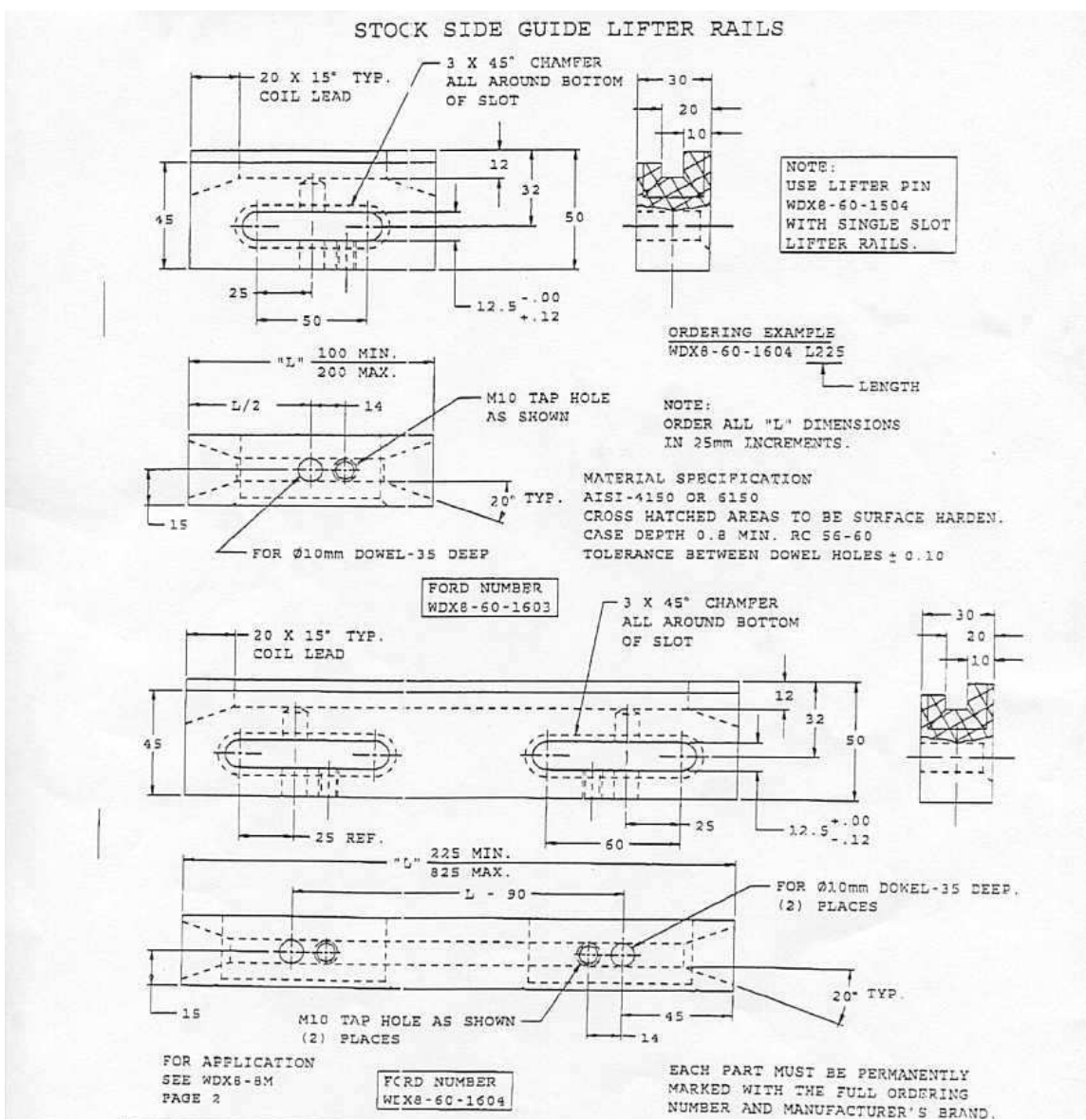
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Progressive Dies


Figure 5.2

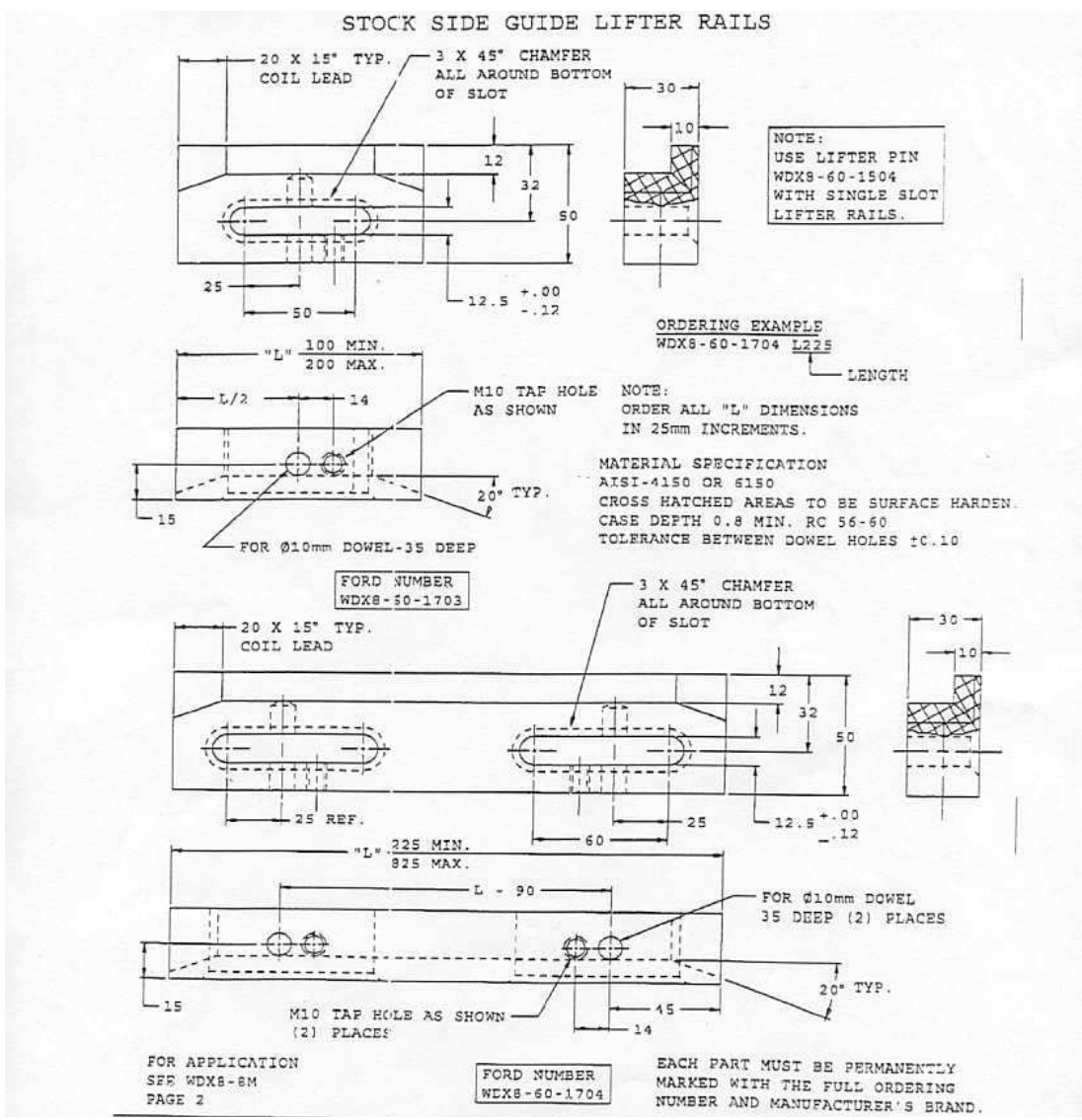
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Progressive Dies


Figure 5.3

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Progressive Dies

Figure 5.4

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General Design for Die Protection

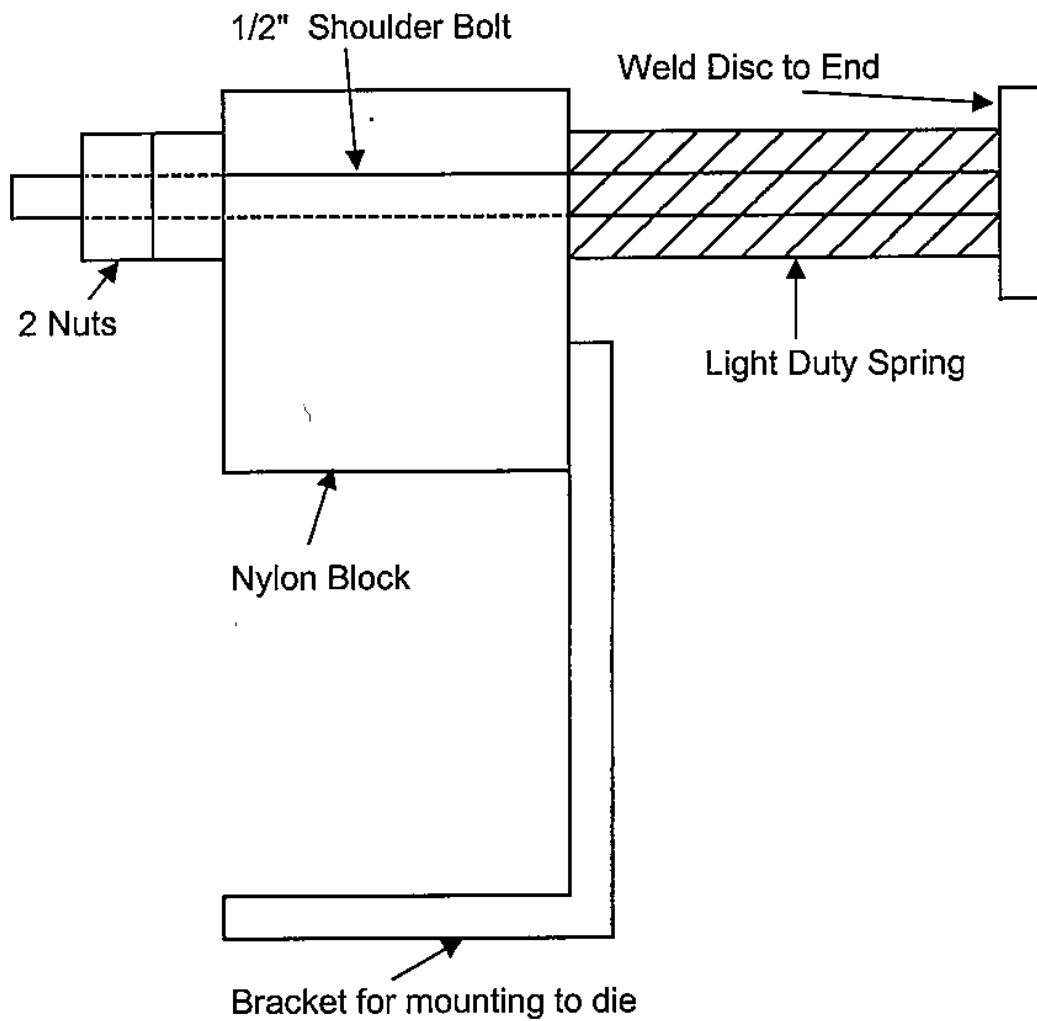



Figure 6

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General Design for Cams

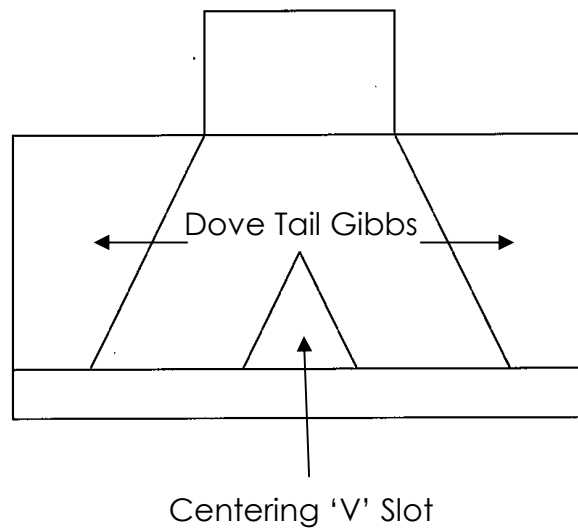



Figure 7

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Revision #:	Revision Date:	Description of Changes:	Sections Affected:	Approved By:
1.0	9/20/04	New Work Instruction	All	MSJ
1.1	2-15-06	Add #92	Section #2	ATR
1.2	2-15-06	Add note #44	Section #2	ATR
1.3	4-27-06	Add note #93	Section #2	ATR
1.4	11-13-06	Revised #78	Section #2	ATR
2.0	10/8/09	Revised and Re-Written	All	MSJ
2.1	1/18/10	Updated #23 page 5 from outside parallel to Tie Down parallels.	Section #2	MSJ
2.2	2/15/10	Removed Safety Block Rest and Limit Switch for Pitch Stop	Section #2	MSJ
2.3	4/21/10	Revised Parallels and made Lift Lugs Optional, added Figure 1b	Section #2	MSJ
2.4	6/15/10	Added Max Weight per Lift to #3	Section #2	MSJ
2.5	7/27/10	#21 Added note on scrap	Section #2	ATR
2.5	7/27/10	#22 Added note concerning HMS style locators	Section #2	ATR
2.6	9/20/10	Added #22 Press 118 and Press 119 Free state Clearance.	Section #2	MSJ
3.0	4/7/14	Revised and Re-Written	All	MSJ