


OBSOLETE VERSION - DO NOT USE

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Revision	Release Date	Description of Changes
1.0	01-April-2012	• Initial release
2.0	01-April -2019	• Transferred to new GSSM template

Prepared		Approved	Released
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Approval records maintained by BOS Team

1.0 Purpose

This standard communicates Adient's minimum set of requirements to the suppliers. It is the expectation of Adient that all suppliers - Direct and Indirect, Supply Chain and Tooling, Machinery & Equipment - comply with all the requirements and expectations documented in the Global Supplier Standards Manual.

2.0 Scope

This standard applies to all Adient 3rd party suppliers.

3.0 Responsibility

All external suppliers (Direct and Indirect, Supply Chain and Tooling, Machinery & Equipment Suppliers) are expected to comply with all requirements and expectations documented in the GSSM.

Suppliers are responsible for reviewing new and revised Adient Requirements including Customer Requirements and determining the impact on their Quality Systems and promoting awareness of the GSSM at their locations

Each Direct and Indirect, Supply Chain and Tooling, Machinery & Equipment Supplier is expected to comply with all requirements and expectations documented in Adient's Global Supplier Standards.

4.0 Process


4.1 Tooling Responsibility

4.1.1 The Global Tooling Engineer is responsible for ensuring ADIENT die specifications are met before, during, and after die construction.

Any exceptions to ADIENT Global Stamping Die Standard must be submitted and approved in writing by ADIENT.

This document will be used as a checklist during the tool buy-off procedure. Each item will be initiated if the standard is met in the tool. If the standard is not met in the tool, approval must be provided by the ADIENT AME (Advanced Manufacturing Engineer). Otherwise the buy-off cannot be completed until the standards are fulfilled.

All tools must be warranted for craftsmanship and production capability for a minimum of 50,000 strokes run in full auto. Tools will be tagged by vendor as warranted until the 50,000 strokes are complete. The warranty starts after PPAP is approved. In the event of a die crash, ADIENT will leave the last strip in the tool and/or provide pictures of the damaged tool to the vendor upon a warranty claim. A report of how many strokes the tool has completed to date will also be provided.

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ADIANT will provide tryout material. Tool must be run-off with material supplied by ADIENT. Tool vendor is required to communicate the tryout material specifications, dimensions and timing requirements to the ADIENT Material Manager. Confirmation from the ADIENT Material Manager and AME must be received and documented that all deliverables can be met. Any deviation from this requirement must be signed-off by the ADIENT AME. On occasion, the ADIENT Materials Manager may ask tool supplier to purchase the tryout material.

The ADIENT tooling purchasing is responsible for ensuring that no purchase order for tools will be released without signed General Specification.

This document will be reviewed regularly by the ADIENT tooling department.

4.2. General Requirements

4.2.2 Design and Manufacturing Process

The ADIENT Tool Data Sheet must be provided upon 100% design review. Any changes in the tool design after the 100% design review must be resubmitted promptly. These data sheets need to be provided to the Plant Engineer Coordinator, AME, and the Tooling Buyer.

ADIANT is to receive progress reports with a summary page (see ADIENT template) on the 10th and 25th of each month; ADIENT reserves the right to request a progress report between these times.

All designs are to be approved by ADIENT prior to die construction. The GTS must provide enough time to perform a proper design review and give one week notice before designs need to be approved. It is the responsibility of the GTS to manage the design reviews in order to maintain program timing.

Strip Lay Out: Submit Lay out to ADIENT for review, arriving at ADIENT 2-3 days before Strip Lay Out Meeting.


Meeting:

- Will be held at designated ADIENT Facility.
- At the discretion of the ADIENT AME the meeting can be done electronically, utilizing Web based visual communications (Web-Ex / Go To Meeting).
- At this review the supplier need to provide for the following.

Progressive Dies:

- Pitch, Coil width, Number of stations, each station identified, all proposed Pilots.
- Tonnage of each Station.
- Incremental forming simulation and the process flow.
- The part need to be nested in the strip for maximum material utilization while not compromising the process integrity.
- Material cards to be defined with the AME.

Transfer Dies:

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- The lay out showing the Feed/Pass Line, the finished part drops off height, the part shown with the correct tip angle for each station.
- The blank pick up height from the destacker or nest station, all proposed Pilots.
- Tonnage of each Station.
- The Incremental forming simulation and the process flow.
- The part needs to be nested in the strip for maximum material utilization while not compromising the process integrity.
- Material cards to be defined with the AME.

General about dies:

- The toolmaker must demand the PRESS and TRANSFER documentations from the corresponding ADIENT plant (press shop), see appendix.
- Tonnage and energy curves of the identified Production press need to be reviewed at this time (see appendix).

50% Design review:


- Will be held designated ADIENT Facility.
- At the discretion of the ADIENT AME be done electronically utilizing web based visual communications (Web-Ex / Go To Meeting / Roll Call).
- At this review the supplier need to provide the following.
- ADIENT requires all designs to be done in 3D CAD, and submitted with a specific tree structure, using specific colors (Section 3.16.3).
- Submit 50% die designs to ADIENT for review, arriving at ADIENT 2-3 days before 50% design review meeting.

Progressive Dies (Items required at this stage include):

- The approved die process shown in upper and lower die.
- The die overlaid on the bolsters/rams with center lines shown, the fastening slots to the press, all working stations completed (it is not required to see all mounting screws and dowels).
- The calculated return force.
- For gas springs on cams (cam stripper if applicable) and stripper pads and an FEA (Finite Element Analysis) for forming.

Transfer Dies (Items required at this stage include):

- Transfer interference curves shown, flow charts for transfer dies, and an FEA.

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- The die overlaid on the bolsters/rams with center lines shown, the fastening slots to the press, all working stations completed (it is not required to see all mounting screws and dowels).
- The calculated return force for gas springs on cams (cam stripper if applicable) and stripper pads and an FEA (Finite Element Analysis) for forming.

The design review sheet must be completed and signed off by ADIENT and the supplier in order to proceed. Requested changes from the supplier AFTER the 50% review must be submitted within 2 weeks and not affect overall program timing. Any exceptions to ADIENT Stamping Die Standard must be submitted and approved in writing by ADIENT.

At 50% design approval:

The SUPPLIER must provide the calculated tonnage required to make the intended product. At least 66% of the press bed should be occupied with a centrally placed die shoe if the available press tonnage (80% tonnage capacity) is to be utilized.

The calculated tonnage must not exceed 80% of the press rated tonnage for the intended production press. It is the responsibility of the SUPPLIER to not exceed the press tonnage at buy-off at the ADIENT/PS facility.

For transfer dies the supplier need to provide the tonnage calculation per station, to be able to calculate the load balance on the ram of the assigned press.

If the die shoe does NOT cover 66% of the bolster, (calculated tonnage exceeds 80% of the press rated tonnage) for the intended press, the tool manufacturer must obtain approval to proceed with design past 50% design approval. Upon approval, the tool manufacturer is responsible to not exceed the actual press tonnage agreed upon by ADIENT at Buy-off at the ADIENT/PS facility. The ADIENT presses monitor all (4) corners of the press for tonnage. Therefore the die must not overload any one corner of the press to successfully complete Buy-off.


100% Design Review:

Will be held at designated ADIENT Facility. At the discretion of the ADIENT AME be done electronically utilizing Web based visual communications (Web-Ex / Go To Meeting / Roll Call). The design will be finalized at this point, which includes all section views, details, and Bill of Material, (in Excel Format). A complete and updated flow chart/process sheet must be provided with the final designs. The BOM must be present for material type validation. The design review sheet must be completed and signed off by ADIENT and the Supplier in order to proceed. A listing of critical spares / special high wear items must be identified at this point.

An itemized bill of materials (BOM) must be supplied for all purchased items.

This BOM must also include the supplier contact information and part number.

All purchased items for dies build outside the U.S. need to be available as shelf item in the U.S., or made available to ADIENT within one week, and need to be cross referenced by a NAAMS.org code.

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It is the responsibility of the GTS to validate the spare part availability and delivery duration at 100% design review.

All designs CAD, CAM and Simulation data are the property of ADIENT.

The Supplier will provide meeting minutes for each design review meeting.

Castings:

- ADIENT reserves the right to be present at all pattern buy-offs. Supplier must submit a pattern buy-off date 2 weeks in advance.

Heat Treat:

- The supplier must supply heat treat certification for all heat treated tool steels. The supplier need to supply a road map for all flame hard, induction or laser heat treated surfaces. ADIENT reserves the right, to randomly check the hardness during buy-off.
- A roadmap of all flame hardened surfaces and radii is needed.

Progress reports / Time Line:

The supplier must issue progress reports (Timeline) to the Program Manager and Tooling Engineer in Microsoft Project (USA), Excel (EUROPE) from the time the P.O. is awarded, until the approval of all dies at ADIENT. (ADIENT will provide template). The ADIENT Tool Engineer has the right to change the frequency of submitting progress reports as the program dictates. ADIENT is to receive progress reports with a summary page (see ADIENT workbook 2016-12-12-rev-01) on the 10th and 25th of each month.

At 100% design review, scrap removal system must be reviewed and approved by ADIENT. The complete die with QDC plates, "dog bones", or any other peripheral items attached to the die must be considered with a scrap removal system in place to avoid all obstacles to allow unimpeded removal of scrap.


Preliminary die design must be shared and approved by the automation supplier (i.e. Transfer Finger supplier).

A flow chart needs to be prepared in general prior to start of tool design. In order to avoid collision during component transportation, the interference curves are to be displayed in the flow chart. The data for the curves is available in the press documentation. A general safety distance of at least 30 mm to the tool is mandatory and to be displayed.

Fragile spare parts are identified by ADIENT during design review and are entered in the Bill of Materials and are to be quoted as line item. It is to be reviewed during try out at the Tool Manufacturer, additional spare parts are required.

All dies will be designed and built to metric standards. Identify that the tool was built to metric standards by stenciling "Metric" on both sides of the tool, top and bottom.

All dies to run "Right" to "Left" unless specified otherwise. Exceptions will be documented and agreed to prior to 100% design approval.

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All tools for presses 300 ton and over must have bi-directional thrust blocks installed on the die set to minimize potential damage if the die is miss-fed. Smaller tools with an off balanced forming load will have extra heel blocks welded on the die set to offset the load. This is to be determined at the design review.

All designs for USA must have scrap going through shoe and part off end of tool. A signed approval from ADIENT will be required for any deviation. A fixed "part out" chute must be supplied with the tool designed for the designated press intended to run the tool. Transfer tools to be supplied with scrap slides directing scrap to bolster openings or scrap conveyors. This must be defined by the 100% design review. The Tool Manufacturer is responsible for scrap and part shed to the edge of the Bolster.

If clearance issues associated to guide pins (transfer tools) are identified during the design reviews, resolution must be identified and signed off by ADIENT on the design review sign-off forms.

When product is designed with a hem, (3) operations will be required in the tool to make the hem. Any deviation from this standard will require sign-off from an ADIENT representative and identified on the ADIENT Design Approval forms.

Parts assemblies and assembled tool may not be wrong or twisted installed. The components need asymmetrical holes patterns for Poke-Yoke.

All non-working edges to be chamfered (chamfer / rounding). Risk of injury!

All Purchased Items on the BOM need to be cross referenced to NAAMS.org


4.3. Data exchange

All documents provided by the GTS to ADIENT must be supplied in English.

Data exchange between ADIENT and customer is done via the DDX-Portal (FTPSERVER). A data dispatch note is generated and sent with each data exchange, including the following Job number as well as date and time.


4.3.1 The Files are identified as follows:

- ADIENT Number_Process Step_REV. Level_Date
- Example: XXXXXXXX_SL_Rev.5_03_22_2012
- Progressive Dies - Strip Lay Out – SL
- Transfer Dies – Process Lay Out – PL
- All Dies - Die Design 50% and 100%- DD_50 and DD_100.
- Information (designation, project number, project manager.....)

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4.3.2 Transfer data

- The ADIENT Tool Data Sheet must be provided upon 100% design review. Any changes in the tool design after the 100% design review must be resubmitted promptly. These data sheets need to be provided to the Plant Engineer Coordinator, AME, and the Tooling Buyer.
- 2D Design drawings or CAD and BOM must be provided to the ADIENT stamping plant and ADIENT AME after tool buy-off.
- Including all surface data used to create and cut any detail that is 3D (trim steels, form steels, pierce detail).
- Detail drawings for all cutting, piercing, form inserts and stripper, window inserts are required if the design is 2D. These drawings must be fully dimensioned.
- 2D designs must have all details ballooned. Details must have a 2D design showing all holes and dowels.
- A part print and cad model will be supplied for the design. It is the responsibility of the tool designer to compare the part print and CAD model and report any discrepancies to the tooling engineer.
- Section views thru all working stations (i.e. non-idle stations). The section view must capture as many features as possible. This must be completed on the upper and lower die sections. Provide section views for both plan of die and plan of punch.
- Provide top view of the lower die. Provide an inverted top view of the upper die.
- Detail drawings required for all cutting, form inserts and stripper window inserts. Drawings must be fully dimensioned.
- An itemized bill of materials (BOM) must be supplied for all perishable spare parts purchased items. This BOM must also include the supplier contact information and part number.
- Detail drawings for each stripper plate and its inserts are required. These drawings must be fully dimensioned. Inserts must include jack screw holes.
- It is mandatory to provide a cam diagram for each cam (2D /3D). This depicts all kinetic movement, angles and calculated forces for the cam operation.
- For details see transfer specification.
- Simulation
 - o At minimum, the GTS must perform a 1-Step forming simulation for any part that has potential of a stretch form.
 - o If the 1-Step simulation shows potential for failure, an incremental forming simulation with production process intend must be completed.
 - o For any part that requires tension and or compression to form the part, an incremental forming simulation must be completed.
 - o If a potential failure exists as the result of the simulation, the GTS must work with ADIENT Engineering and AME to resolve all potential forming issues before 100% design sign-off.

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- o All forming simulations must be performed using inputs that would establish worst case material properties for potential splitting based on the material specification on the drawing. This should also be performed at the low and high end of the material tolerance. It is the GTS's responsibility to obtain all the appropriate specifications to perform the most accurate analysis possible.
- o ATE provides the material cards for the simulation or it has to be agreed with GTE, which material card is simulated.

Written approval from ADIENT must be obtained by the GTS for any part the GTS pleads does not require a 1-Step or incremental forming simulation.

ADIENT_Incremental_Formability_Simulation_Template-rev-01 or
Adient_SimReprt_Template-rev-001

ADIENT Incremental Formability Simulation Standards_rev-01

Material cards are to be matches with ADIENT AME

4.4. Buy-off

4.4.1. General

Unless otherwise approved in writing, dies must be designed and built to run at the defined minimum strokes per minute (SPM) as quoted in quote response. If required SPM cannot be met, an explanation in writing detailing the restrictions must be included in the quote with the estimated achievable SPM.

Die run-offs will require die to be run at the defined SPM for the 300 piece run in the GTS's specified press and for 90 continuous minutes at the ADIENT/CM stamping facility.

The intended stamping material lube must be used during tool run-off. Lube specification will be supplied by stamping source upon request from the GTS.

Parts must fit quality gage.


Six (6) piece dimensional CMM layout to product print per quality measurement plan. This must be provided and approved by ADIENT/CM before buy-off visit is scheduled.

A minimum cpk of 1.67 must be achieved on a 30 piece sample on all SC's and CC's as identified on the drawing. As specified in the ADIENT Characteristic Management Standard.


Transfer dies must be run all under one ram at the Tool manufacturer's Press, and in auto with the production intended transfer bar/fingers at the ADIENT Facility tool buy-off, at the rates identified on the quote response.

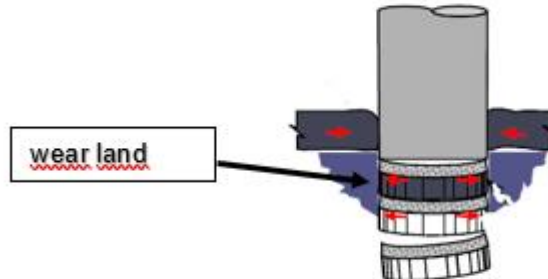
4.4.2. Buy-off requirements at Tool Manufacturer:

- Static & Dynamic Reviews and Run-offs at the Supplier.
- Supplier part(s), data, and static review check sheets must be sent to ADIENT for approval and concurrence, prior to scheduling the static and dynamic Run-offs. Static and dynamic reviews will be done in 2 steps.


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- Static Buyoff/Review:
 - o Will take place after good parts are produced and checked on the fixture and CMM. (6-piece full part layout). The tool is completely assembled. This is to validate; the die is built correctly as agreed at the 100% Review.
- Dynamic Run-off:
 - o The dynamic buy-off will consist of a 300-piece production run, run continuously. In the case of a progressive dies, the 300 pieces must be run continuously from coil at the quoted rate. The dynamic buy-off will not be completed until the 30-piece study meets the quality requirement, as specified in the ADIENT Characteristic Management Standard and the 6 piece full part layout satisfies all quality requirements. Shipping of the tool commences when all open issues from the static and dynamic buy off, listed on the tool buy-off check list are closed.
- If the Supplier fails to meet the requirements of dynamic run off and it requires another trip for the ADIENT Team to fulfill this requirement. The ADIENT trip expense will be at the tool manufacturer's cost.
- The Tool Manufacturer building the tool is solely responsible for all engineering, interfacing, debugging of all dies (coil fed transfer and progressive), and has sole responsibility to make an acceptable production part, and achieve a PPAP.
- Dynamic buy off for transfer dies: Hand transfer the parts at the die shop.
- Die is to be opened for inspection after 300-piece run-off at GTS location. This may require the tool to be disassembled.
- A Circle grit analysis need to be performed at the die shop at first die cut parts, not to exceed the material specific thinning limits per steel supplier and ADIENT requirement.
- A Circle Grit Analysis Report includes pictures with by number identified measuring points on the formed parts (Draw, Redraw, Flange ops.). The thinning limit diagrams need to show bar graphs per identified point and operation checked. All as marginal or unsafe identified points need an action plan showing action and closure date. The SUPPLIER needs to give advanced notice to ADIENT and for the steel supplier's representative to be present for the production of the Circle Grit Panels.
- The circle grid analysis report will be issued by steel supplier. If Circle grid is not feasible, checks with point micrometer and Ultra sound checks can be substituted (FTLC = Thinning Limit Curve), with ADIENT's and Customer's agreement.
- The Steel Supplier needs an advanced notice of 2 week to coordinate the Circle Grid Analysis with the die shop.
- Scrap must not accumulate more than 5 strokes on all other trimming or piercing operations and fall away freely from the die once the wear land is passed.

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- Screws must remain tight after the run, or corrective action must be taken.
- Complete bench review/tear-down of the tool at the GTS's facility after tool run-off.
- The buy-off check (i.e. ADIENT Global Stamping Die Tooling Standards) sheet must be completed by the vendor and submitted to the ADIENT AME before the tool is to be run-off.
- Buy-off requirements at ADIENT facility:
- Will consist of a PSW run, run at ADIENT, which can be segmented in trial runs, not to exceed 8 Hrs. of production press time. The Tool Manufacturer must be present for technical support, at ADIENT discretion.
- The capability requirement as specified in the ADIENT Characteristic Management Standard.
- Any additional time will be at the Suppliers expense.
- A hard copy of the completed tool project book must be present to commence Home Line Commissioning (USA).
- Tools must operate 90 mins. at rate in full auto. Stops allowed not attributable to die issues.
- The 90 mins. requirement may be reduced at the discretion of ADIENT.
- Scrap must fall each stroke on any bypass cutter.
- Screws must remain tight after the run, or corrective action must be taken.
- Final die buy-off requires receipt of 100% updated cad die design with BOM delivered at time of run-off.


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4.4.3 Tool Acceptance and Final Payment

- The following is the estimated timeframe, which will be allocated for home line try out at ADIENT.
- All dimensions in specified tolerance
- Run at quoted speed for 90 minutes (RFQ).
- No material thinning or compression issues on the part. (Circle Grid Report or TLC)



- All tool issues addressed and closed.
- 100% updated cad die design with BOM and CAD/CAM delivered at time of run-off.

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4.5. Tool

4.5.1. Tool Steel Material

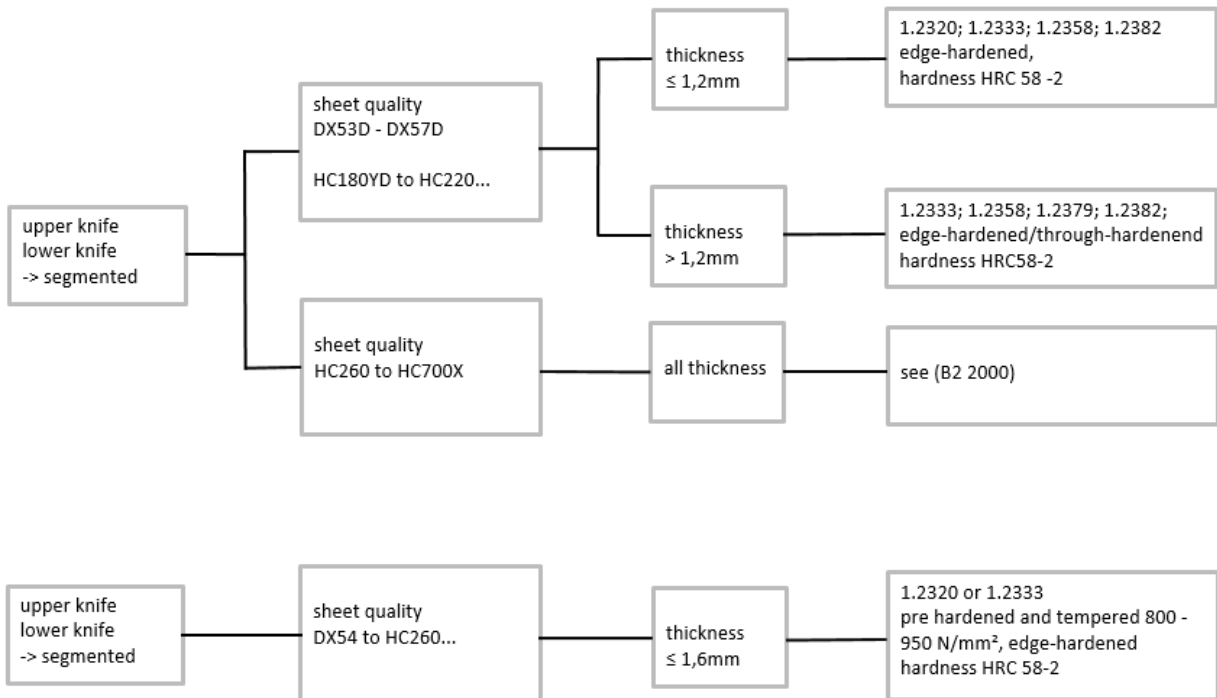
International Material Equivalency International Material Äquivalenz					
Classification	DIN	AISI / SAE USA	GM	JIS Japanese	ISO Europäisch
Tool Steel (High alloy tool steel)	1.2363	A2	A2	SKD 12	X 100 CrMoV 5
	1.2379	D2	D2	SKD 11	X153CrMoV1 2
	1.2510	O1	O1	SKS 3	
	1.2833	W2	W2	SKS 43	
	1.2333	S7	S7		
High Speed Steel (HSS)	1.3344	M2	M2	SKH 51	HS 6-5-3
Alloy Steel (Low alloy tool steel)	1.0402 / 1.0414 1.0480 / 1.0044	1020	1020	S20C	
	1.1186 / 1.0511	1040	1040	S40C	C40
	1.1206 / 1.0540	1050	1050	S50C	C50
	1.0601	1060	1060	S60C	C60
	1.6523	8620	8620	SNM220	20NiCrMo2
	1.7225	4140	4140	SCM440	42CrMo4
	1.7228	4150	4150	SCM445	50CrMo4

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	1.8159	6150	6150	SUP10	50 CrV 4
Gray Cast Iron	0.6025	G2500	GM-238	Fc 250	EN-JL 1040
	0.6025 CrMo	G3500	GM-241	Fc 250	EN-JL 2050
	0.7040 (GGG 40)	D-4512	GM-245	FCD 400	EN-JS 1030

Picture 1: Material Comparison USA- Europe - Japan



Picture 2: Materials for cutting elements

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- If not mentioned otherwise, see ADIENT Comparison Sheet for Materials.
- High-strength sheet metals are defined as sheet metals with a yield point of more than 450 MPa. $R_{p0,2} > 450\text{MPa}$
- All forming areas have to be equipped with Tool Steel. Base structures for upper and lower Transfer Tools are casted (for material see ADIENT Comparison Sheet).
- Absolutely no welds or fitted plugs on cutting steels and forming.
- All extrusion sizing punches must be coated. All other extrusion punches will only need to be coated if galling is detected at run-off.
- Lower trim steel thickness $> 50\text{mm}$ (about 2") minimum.
- For sheet metal over 450MPa, thickness $> 63\text{mm}$ (about 2.5 ") minimum.
- All Surface in which a material movement is occurs need coating. Kind of Coating must be approved by ADIENT.

4.5.2. Tool Dimensions and Tonnage

Tools are to be dimensioned based on determined presses (see press documentation).

The following heights are defined:

- Shut height of tool.
- Working height of tool.
- Feed height/line.

Length and width of tools depends on allocated press (see press documentation)

Working parts of the tool may not extend beyond the peripheral limits of the die-set without written authorizations from ADIENT. This should be captured in the die design sign-off forms.

The ADIENT presses monitor all (4) corners of the press for tonnage. Therefore, the die must not overload any one corner of the press to successfully complete Buy-off.

4.5.3. Parallels and Common Plates

Large radius on common plates and castings in the region of the transport elements for the protection of the ropes.


The design determines how the body should look after editing. Pay attention to the following points:

All parallels are to be ground top and bottom.

Lower parts are bolted to the base plate. The dimension of the screw joint (quantity, position and screw size) shall also provide safety when the lower parts are turned.

Upper parts are bolted to the head plate(s) are to be face mounted, to be accessible when tool is opened up. The dimension of the screw joint (quantity, position and screw size) shall provide sufficient safety.

Common plate: Multiple tools are installed in one base plate. Upper parts are bolted to the head plate.

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If possible, keep the draw tool /form tool separate from the trim and pierce tools to prevent rocking due to uneven force, which can result in premature burrs on the trim and pierce tools.

Guide bushings and guide plates are to be designed with standard “bronze with solid lubricant” parts. They have to be secured against pulling off.

- Retaining washers or retaining clips are required.
- An asymmetrical arrangement of guide elements is required (anti - twist protection) to avoid incorrect assembly of upper and lower part.
- Minimal guidance of 40mm is required in the intake during the cutting process. Wear plates need to enter 40 mm prior guide pins were applicable


The guide pins are arranged in the upper part, the guide bushings in the lower part.

Threaded jack screws are to be implemented in all form and trim steels as well as windows. Jack screw, mounting screw as well as dowels should be of the same dimension, when applied in a component.

Proper feed line and shut height to be maintained on all dies, only NA.

Group	Length	Shut Height	Feed Line
1	> 3657,6 mm (144")	1016mm (40")	609,6mm (24")
2	1524mm – 3657,6mm (60"- 144")	609,6mm (24")	355,6mm (14")
3	508mm – 1524mm (20"-60")	406,4mm (16")	254mm (10")

Table 1: Die Dimensions

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Parallels used for locating must be dowelled to the die shoes and sub plates (if present). If QDC locator holes are used, they cannot be in line with the clamp slots.

Parallels must have slotted feet for clamping. Slots will be 28.5mm wide and 65mm long. The position of the upper and lower clamping slots must match the ADIENT/CM press specified.

- Clamping flat area must be 100 mm long and wide.
- Clamping height above press ram and bolster must be 50 mm.

It is to be ensured that the width of the upper part is within the travel path (stroke) of the clamping elements.

2 QDC locators shall be provided for each common plate.

For QDC locator hole sizes and positions see correlating information for assigned press.

4.5.4. Standard Parts

If procurement of a standard part is not possible until the required deadline, exemptions are possible, which are generally to be coordinated with the manufacturer.

Minimum thread engagement must be 2 times the diameter of the bolt.


Specify size of screws to be used for construction of the tool in the preliminary design review. Use only SAE 1960 series socket head cap screws of equivalent.

Use only premium unaltered hardware (all purchased items, including fasteners, company HOLO KROME or equivalent)

Screw threads tapped into hardened steels must be 3mm counter-bored to prevent cracking out.

All screw holes to be positioned clear of component geometry to prevent marking of component.

If additional lube is required throughout the tool, oiler and oil lines must be permanently installed in the tool (nozzle type per plant requirement).

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4.5.5. Die Sections

All die sections are to be face mounted for removal in press. Sections to include jack screws.

All sections are to be bolted such that when the section is sharpened and shimmed the die clearance and longevity of the trim steel is not affected.

All sections heavier than 13 kg (about 35 pound) to have handling hole to allow for removal of section by overhead hoist. Large sections must also have wedge slots to assist in loosening the section.

Lower trim steel thickness > 50 mm (about. 2") minimum. For sheet metal over 450MPa, thickness > 63 mm (ca. 2.5 ").

Use die materials, which are adequate for the service and life of the die. Do not use materials that exceed the requirements, are not cost effective, could cause program delays, or increase die maintenance costs unless approved by ADIENT AME.

Flange steel retainer need to be constructed in such a manner as to minimize deflection during flanging operation (height to base width ratio 1:1.5, keys, heels).

Back-up the flange retainers with keys for the entire length of retainer. Position the mounting screws as close to working edge of flange retainer as possible.

Trim/flange posts must be inserted with tool steel.


Details under 150mm in length must have a minimum of 2 screws, 2 Jack screws and 2 dowels, all of the same nominal diameter.

Details over 150mm in length must be have a minimum of 4 screws, 2 Jack screws and 2 dowels, all of the same nominal diameter.

All doweled and/or tight-fitting details must be drilled and tapped for a minimum of 2 jack screws, with the exception of doweled buttons.

Dowels to be reamed 2 times diameter deep in the die shoe or sub plate. With a smaller clearance hole drilled through were ever possible.

Dowels should be press fit into die shoe and slip fit into sections. Provide through hole to remove dowel pins (Dowel holes reamed through the whole die shoe is not permitted).

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Absolutely no blind dowel holes.

Triple draw heat treat process is required on all tool steels. Heat treat certification stating triple draw must be provided on all tool steel.

All form steels are to be inserted allowing for easy adjustment.

Die sections must have a minimum wall thickness of 10 mm between pierce holes. If part design does not permit, a product change request must be submitted in writing to ADIENT. If product change is not approved the area in the tool with this condition must use an insert that can be changed in the press. This condition is deemed fragile must also be approved and signed off by ADIENT during the design review process.

Provide clearance holes through the die shoe for all slugs and pilot holes.


All cutting sections must have 10mm diameter minimum socket head cap screws and thread engagement must meet bolt specification.

Top of socket head cap screw to be pocketed 10mm below the die life of die section to allow for sharpening.

Counter bore depth for sheet metal over 450 MPa, need to stay 60% off bottom of base surface. All pierce buttons to be headless and key retained for easy removal. In a perforation pattern too small for inserts, use wire burned sections instead of buttons.

All buttons must incorporate tapered relief. Standard relief (step relief) buttons should not be used. Where areas of the part are likely to wrinkle or overlap material, a blank holder/ binder is required along with nitrogen springs. Bolt and dowel holes must not extend into working surfaces.

Blank holder / binder must have balancing blocks to keep the pad level if the design concept of the die steels does not guarantee a balanced condition.

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4.5.6. Pierce Punches

FOR USA: Commercial ball lock punches must be made of M2 steel. For tools that have a yearly planned volume that exceeds 1 million and/or have a material specification for the product with SAE J2340 420XF (JIS G3135 SPFC 540) or harder must come supplied with special wear resistant punches. Material type and/or coating must be approved by ADIENT in writing at design review.

For USA/ EUROPE: All punches and punch access windows will require a dimensioned 2D design.

For USA/ EUROPE: Punches of similar size or shape must have different body diameters for error proofing

For USA: All punches require slug shadders unless punch size/shape will not permit.

For EUROPE: 6 mm +

For USA/ EUROPE: Punches that cut only on one side must be heeled, with the heel entering the die before the punch contacts the material. Heel blocks must not be steel on steel, Ampco type material must be used on one face. Heel blocks must be keyed to die shoe.



For USA/ EUROPE: Smaller shaped trim punches may be mounted in several ways, as most appropriate for the punch shape and space available in the die. The method selected must be approved by ADIENT at design review.


For USA/ EUROPE: Smaller shaped trim punches should be mounted in a quick change holder.

For USA/ EUROPE: Smaller shaped trim punches should be heeled into a special punch holder.

For USA: Smaller shaped trim punches can be in wire burned punch holder with hardened washer (minimum 6 mm thick) and screw. Minimum 8mm screw size.

For USA/ EUROPE: Taper locking punches in retainers are not allowed.

For USA/ EUROPE: Minimum of (2) bolts per retainer/holder required.

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FOR EUROPE: Use Headed Punches.

For USA: Direct Trimming/Piercing is not allowed over 15 degrees normal to the part surface.

EUROPE: 8 degrees.

For USA/ EUROPE: For punches smaller than 15mm, the pierce angle may not exceed the punch diameter size in the amount of millimeters to degrees.

For USA: Under 5mm ->5°, 6-10mm ->10°, 10-14mm ->14°, and 15mm-above 15° any deviations must be approved in writing. Inserts need to be utilized in these areas.

For USA/ EUROPE: No Knife edges on finished Parts

4.5.7. Die Shoes

Cast die shoes for Progressive Tools (USA) are only allowed by special permission in writing from ADIENT. If approved, GM 238 is required for casting steel. Certification must be provided to ADIENT from the foundry. Special pattern review required on casting prior to foundry. No upper geometry may be cast into die shoe. Absolutely no cast cutting steels are allowed.


The cast iron must be (as well as the entire tool) free from corrosion residues in the specified colors (RAL project dependent) painted in delivery condition and all bare surfaces shall be protected against corrosion. Cast tool steels are not permitted for forming or cutting steels.

Foundry wall thickness for transfer tools depends on the tool size and used material: 60 mm for over at draw punch und die plate. 50 mm for outer ribs and circumferential ribs. 50mm for horizontal casted bases 40mm for internal ribs.

4.5.8. Ribs in cast iron

Cast ribs are to be arranged to ensure transfer of power flow, i.e. ribs are mandatory below form tool steel inserts, cutter steels, stop blocks, safety pad areas, spacers etc.

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Arrangement: Ribs have to be arranged irregularly to gain higher strength.

Example:



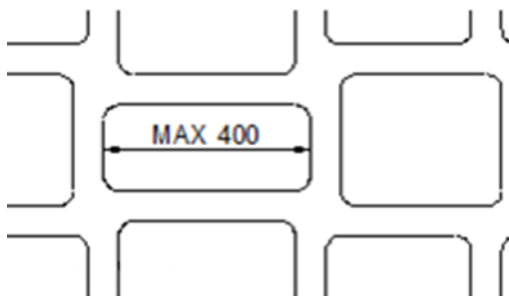
not okay




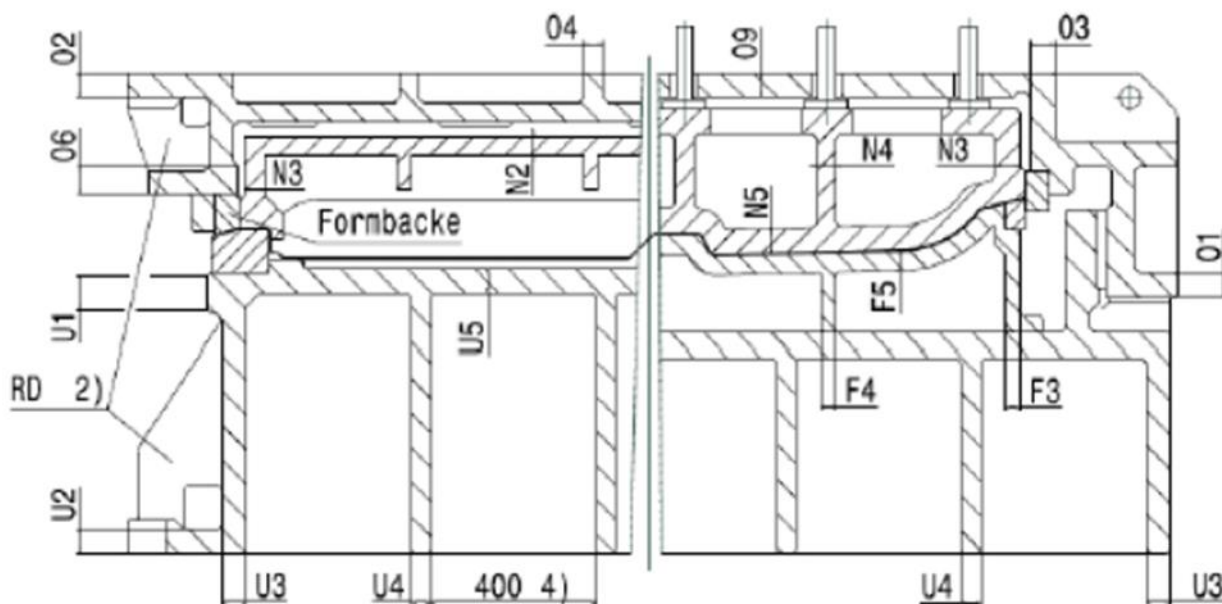
okay

Ribs below spacers: In case of extreme load values may be increased. It is essential that all spacers are placed on rib, i.e. they are supported.

For sheet metal between 450 MPa and above, reduce core size to 400 mm maximum, on non-working areas. 300 mm core size is the maximum under working/load areas.



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Picture 2: Thickness and Arrangement of Ribs

Material	tool top						tool base					forming pin / bit op top			blank holder				RD
	O1	O2	O3	O4	O6	O9	U1	U2	U3	U4	U5	F3	F4	F5	N2	N3	N4	N5	
EN-JL-...	50	50	50	40	50	60	60	50	50	40	50	-	-	-	-	-	-	-	40
EN-JS...	50	50	50	40	50	60	60	50	50	40	50	-	-	-	40	40	40	50	
cast steel	-	-	-	-	-	-	-	-	-	-	-	30	30	40	35	30	30	40	
GP4M	-	-	-	-	-	-	-	-	-	-	-	30	30	40	-	-	-	-	


For highly stressed draw tools with high stroke, high surface pressure, etc. and in areas sensitive to wear induction hardening is to be used and subsequently, as needed for BH surfaces, draw radii and form edges, plasma-nitrating to be performed.

Instead of induction hardening also laser hardening may be used.

Each die set (sub-die) must have 4 guide pins with ball bearing guides. One post must be offset to avoid miss-assembly of the die. For dies in presses less than 400 ton use 50mm guide pins. Tools for presses 400 ton and over use 75mm guide pins (ball bearing only NA).

Two post die sets will not be accepted, except in transfer conditions where bars need clearance, and only by specific ADIENT authorization at design review.

The guide pins must be adequately dimensioned. The space of the tool and the clearance of transfers must be noted.

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All areas that could trap water are to have drain holes routed toward the outside of the die away from the operator, 40 mm minimum diameter.

All ribs in both upper and lower die shoes must have cores holes added for the possible addition of wires, sensors, hoses, or pipes, 75mm diameter minimum.

For steel castings use 25mm radius fillets, for cast iron use 25mm radius fillet or 5mm x 45 degree chamfer. Cast all clearances for nitrogen cylinders, plates, hoses, and fittings.

Cast coupons are required for all cast components. It is the supplier responsibility for all testing and certification of coupons.

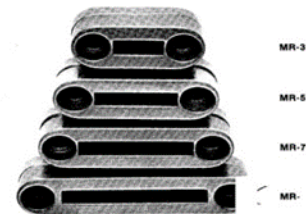
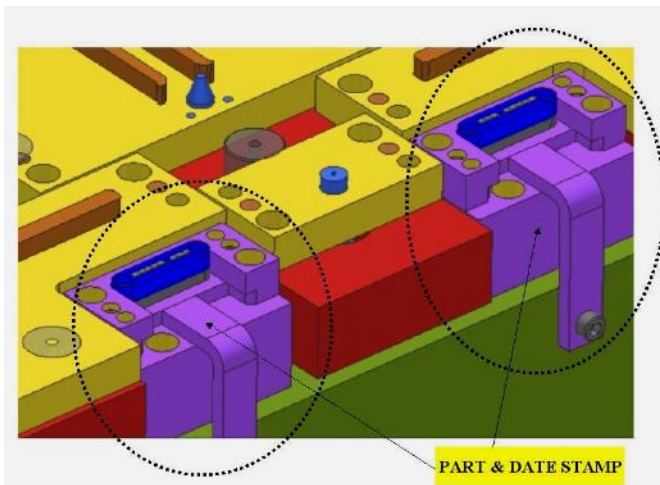
All working surfaces, including blank holder / binder, must be hardened (induction hardening preferred). Hardened area must exceed blank perimeter.

Test coupons are to be attached 90 degrees from the flame hardened surface. The coupon must be attached to the tool at all times.

The chemical analysis from the foundry needs to be supplied to ADIENT if requested.

4.5.9 Part Identification

All dies need in press exchangeable stamp retainers for Julian date located on the coil entry side in the upper or lower die set. Use the example shown. Deviations require



**GENERAL MOTORS TYPE
TAPERED STAMP RETAINER SET**


ARGON NO. MR-3	Holds 3 stamps
MR-5	Holds 5 stamps
MR-7	Holds 7 stamps
MR-9	Holds 9 stamps

Holds 1/8" high character tapered stamps (3/16" wide), type ARG-180.
 Each retainer can hold twice the number of stamps by using the narrow tapered stamp (3/32" wide, 3/32" high character), type ARG-090.
 These retainer sets are specified by various numbers depending on the design standards of each G.M. division.
 Call ARGON, for cross reference information. For detail information, see see sheet 9.



ADIANT sign off and approval. Part number retainer: Use best fit.

ADIANT Engineering must approve stamp location and type if not specified on part print.

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Use Aragon brand stamps or equivalent taper lock type.

Use 9 position holders for part number, use 5 position for Julian date and year.

Date and part number stamps must be in place during any early part builds and tool buy-off runs.

Figure: stamp retainer quick change concept lower die.

Two out identical part dies must have cavity identifiers (i.e. F & B, L & R, X & Y).

4.5.10 Coil Feed and Guidance

All transfer tools are coil fed.

For feed line height information see technical requirement of assigned press line.

Provisions in the tool (ex. lifters in the lower die) must be accommodated to feed the initial strip for set-up through the tool unassisted. If it is identified during design that the product does not lend itself to incorporate this feature in the tool, this must be identified in the ADIENT Design Review Approval forms and signed off by an ADIENT representative.

Two outboard hard stock guides are required on progressive and coil fed transfer dies. These guides must be at least 150mm long with the guide on the front of the die to be adjustable to accept 6mm wider coil. The rear one need to be ½”longer for easy stock feed in at coil start. 1 key minimum for rail adjustment.

The stock rails must be hardened a minimum of 50-54RC throughout the die material type: 6150. The rails must be inside of the die shoe parameter.

Cylindrical slotted stock guides are not allowed in dies unless authorized in writing by ADIENT.


All coil fed dies to have a start pin in the lower die shoe, extending 12mm above the feed line. Use a weak guitar wire spring to actuate. The intention is not to support the strip, but create a positive stop for coil start.

Feed complete will be checked at the end of the progression tool, respective at the end of the blanking operation on transfer tools. The information for sensor mounting blocks and configuration will be provided by ADIENT Stamping source, and reviewed at 50% review.

Add feed complete sensor for the blanking station in transfer tools.

The pitch notch is to be used as the “first hit” indicator. If the “first hit” is other than the notches, a start line must be scribed in the die.

The first pilot hole need to be pierced when the coil is against the pitch notch stop.

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Part present check is done in transfer presses the gripper/vane. Part presence sensors need to be attached to gripper/vane.

A visual first hit line is required on transfer tools.

The blank holder provided with guide pins, gas springs and locking screws.

Add wear plates to absorb one-sided thrust forces on trim steels.

If an incomplete part or a slug is generated when a new strip is started, a sample part or slug must be painted red and riveted to the die shoe at the position it has to be removed from the die.

All sensors must be proved out at the die buy-off at vendors facility.

All sensors must be fully protected to prevent damage that may be experienced in a production environment.

In transfer tools, the blank can be directly cut and drawn in the draw station by a "shear cut". The blank can be cut in the first and drawn in the second step.

Trim steel material (see ADIENT comparison 2 on page 12)

4.5.11 Strippers

Only strippers made of steel may be used. All stripper pads are to be constructed of 1020 steel.

All contact surfaces to part and gas springs to be 4140 or 6150, hardened.

Flattening, forming, trimming and coining steels must go through the stripper.

Polyurethane strippers are not permitted. Exceptions only allowed with written approval from ADIENT during design review.

Punching through the main blank holder is not permitted.

Minimum stripper thickness for dies over 1500mm in length is 35mm thick minimum.

Cutting steels may not be mounted to strippers.

Working strippers with hardened form inserts must be guided with guide pins and bushings sufficient to properly contain them (USA). No standard lifter for stripper with side load or thrust.


Strippers with inserted pilot pins need to be on pins and bushings.

Strippers must be retained with keeper blocks and/or standard size spools with 12mm bolts minimum.

Spools must be accessible and removable without removing nitrogen units, parallels, etc., from the die.

Shoulder bolts may not be used for retaining strippers.

Keepers are to be fixed with min. (2) 12mm bolts. For dies over 600 ton use a min. of (4) 16mm bolts.

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Preferred square footprint on die shoe for keepers.

Strippers should have window inserts allowing for removal of punches while the die remains in the press.

Flat windows may be pocketed into the stripper for location. Bolt & dowel hole pattern must be designed to prevent incorrect installation.

Contoured windows must be dowelled to the stripper for location. Dowels need to be prevented from falling out.

Windows must have threaded jackscrew holes for removal (same thread as retaining screws) and face mounted in die.

Strippers need 12 mm clearance from stripper pad surface to top surface of trim/ pierce retainer, or need be cleared out so punches can be shimmed 10mm minimum. No shoulder screws.

Clearance around punches through windows should be half product strip thickness.

Cams for piercing or trimming must have spring / nitrogen strippers at cutting interface. Fixed “bridge” or “finger” strippers are not permitted unless written approval at design review is signed by an ADIENT representative.

In the case of tools with deep extrusions, each stage of the extrusion must have a separate stripper insert. These may be mounted on a common stripper plate. The extrusion punches should be headed (i.e. not ball lock) and the stripper window should be large enough to remove the punch holder in the press.

4.5.12 Cams

All cams shall be designed with U and V Blocks.

Standard cams shall be used where applicable.

All cam backstops must be keyed or have a cast step of sufficient size.

All cam drivers and posts must be keyed.


All cam drivers should be the width of the cam working area.

The Cam length to height ratio must be 1.5:1 minimum (Length 1.5 x height of the cam.)

Cams should be returned by nitrogen springs.

All cam trim and pierce units must be removable in the press.

Aerial cams not allowed unless authorized in writing by ADIENT.

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Cams for piercing or trimming must have spring / nitrogen stripper pads at cutting interface. Fixed “bridge” or “finger” stripper pads are not permitted unless written approval at design review is signed by an ADIENT AME.

All cams and cam slides must work on commercially available wear plates with self-lubricating graphite plugs (Ampco 21 or similar), unless the cam design requires a dwell action. Steel on steel is unacceptable unless approved by ADIENT in writing at design review.

All cams that form or require sensitive timing should dwell in the closed position to make the shut height of the press less critical.

The Cam Driver need to contact 2/3 of the Cam surface prior to contact the part surface. This will prevent the Cam Slide from diving, causing uneven wear to the wear plates under the cam slide.

4.5.13 Lifters

Lifters have in general a round (oval) form.

Easy dismounting of lifters with Gas Springs. The Gas Springs need to be exchangeable from above.

A key is to be implemented for anti-rotation protection.

Lifters have to be chamfered.

Gas springs are to be used. The gas springs need to be secured. Address Gas Spring Brand preference with assigned Stamping Source.

For Transfer Tools, use Pneumatic lifters with end position damping. Lifters must be removable in press (face mounted).

4.5.14 Part Index


Machined surfaces need to be available in each station of the transfer tool process for rough index mounting.

The positions of the rough index are established during design review.

Do not use welded rough index. Casted rough indexes (purchased part) have to be installed.

Do not locate off of part form. Use only rough index, to locate the part on pilots, or trim edge of the part.

Rough locators must be adjustable in the press. Clearance must be provided in the opposite die shoe for the full range of adjustability on the rough locators. Rough guide locators must have a minimum of 25 - 40 mm lead in.

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4.5.15 Pilots

All pilot buttons to be keyed or headed and have 0.05mm. Clearance per side maximum above pilot diameter. Buttons that are headed must be held by means of inserts avoiding removal of large sections to replace the buttons in the press.

Pilots pins must be capable of removing in press.

All pilots to be a minimum diameter of 10mm. Preferred diameter is 15mm.

Pilots are to be “positive pick-up” style with a slug clearance hole drilled through the die shoe.

Pilot holes may not be pierced before the strip is against the pitch notches.

Transfer tool pilots, or part locators, or lifters in lower die are to be easily removable in press. Pilots are to be held by keys or small inserts with jack screw provisions added.

Different size pilots within the same tool must have different body diameters for error proofing.

Stripper pad mounted pilot pins are permitted only by signed approval from ADIENT. The pad must be fully guided, and the pilots must have ejector pins beside them in the strippers/pressure pad.

Stripper pad mounted pilots that are held in by windows cannot share the window used for punches or trim steels.

Threaded pilots are not allowed.

4.5.16 Scrap Exit


The tool Manufacturer is responsible for scrap shed under production conditions to the edge of the bolster, or the scrap openings in the press bolster. Die internal scrap chutes need to be constructed of demountable sheet metal. (chute material: Rigidized metal, (RGM or 1.WB).

All scrap has to be discharged out of the tool always 100%.

Scrap must fall each stroke on any bypass cutter.

Scrap must not accumulate more than 5 strokes on all other trimming or piercing operations, and fall away freely from the die once the wear land is passed.

Maximum slug size is 150mm x 300 mm.

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The longest scrap side is measured (diagonally) which must not exceed (see data sheet of press) 300mm.

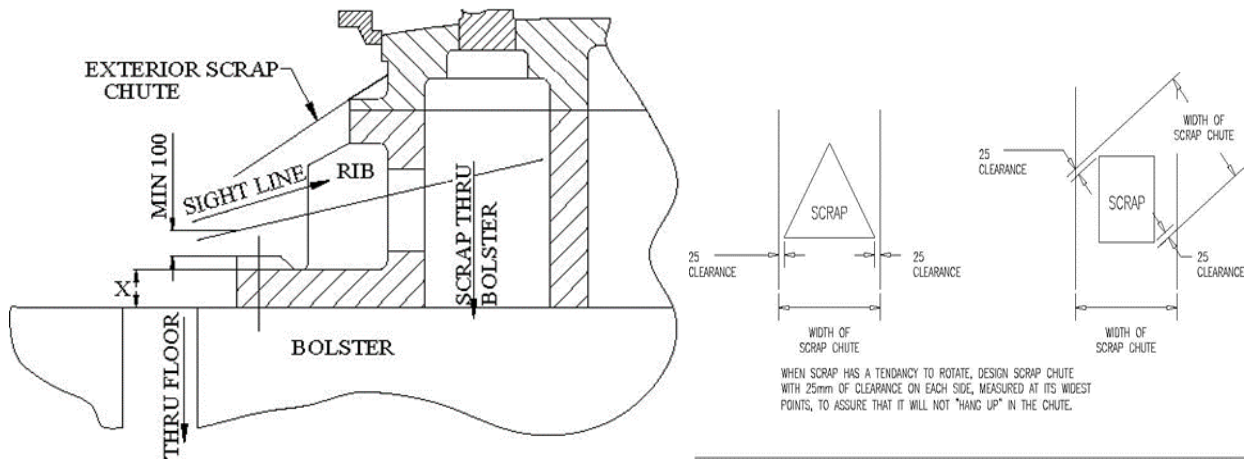
This is stringently to be considered when designing the method.

Scrap chutes should be ca. 40mm wider than the size of the scrap.

Ample slug clearance must be provided. Scrap openings must be 25mm larger than the dimensions of the scrap, unless authorized in writing by ADIENT in the design review process.

To ensure a secure sliding-off of scrap, defined angle for the chute are to be observed.

25° = cutting scrap and big piercing scrap; 30° = for smaller piercing scrap.



Foundry opening are to be completely closed.


For USA: All designs must have scrap going through shoe and part off end of tool. A signed approval from ADIENT will be required for any deviation. A fixed “part out” chute must be supplied with the tool designed for the designated press intended to run the tool. Transfer tools to be supplied with scrap slides directing scrap to bolster openings or scrap conveyors. This must be defined by the 100% design review.

For EUROPE: Scrap need s to go to the edge of the bolster (See Press specifications). Part exit end of tool. Part and scrap cannot fall off the die at the same place, they must be separated.

Provide through holes in the die shoe to remove all scrap and slugs produced in the tool.

Sight line of 50mm (about. 2”) minimum between die chute and lower surface of die shoes required on steel plate dies (drop through bolster).

Sight though windows to be provided in cast dies holes to monitor scrap fall in production.

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4.6 Safety Devices

If retaining screws are used for ejector plates strippers etc. the stroke of the locking screw 10 mm is bigger than the stroke of the retaining screws.

Four safety areas are to be included in the upper and lower part. (160mm x 160mm).

One safety-block location to be provided on each side of the die.

Four spacers made of steel and with locating grooves are required for each transfer tool operation. The spacers are located on a machined surface at all 4 edges of the tool. A sufficient surface pressure is to be observed (big enough).

All dies to have a minimum of four stop blocks.

Split stop blocks mounted on upper and lower die only with ADIENT approval (Transfer Tools).

Blocks must be a minimum of 50mm diameter.

Stops to be manufactured to the exact inside shut height. Each stop block to be grooved at the center 10mm wide and 1.25mm deep.

All stop blocks to be located between upper and lower parallels or cast wall / ribs.

For USA: Die storage blocks required on all tools for presses over 500T. "Flip-out" urethane blocks (i.e. Destaco Die Storage Bases/Blocks) should be used.

All tools for presses 300 ton and over must have bi-directional thrust blocks installed on the die set to minimize potential damage if the die is miss-fed. Smaller tools with an off balanced forming load will have extra heel blocks welded on the die set to offset the load.

Thrust blocks must have Ampco 21 or equivalent wear plates with graphite impregnated composition inserts.

4.6.1 Springs and Nitrogenes

In general standard nitrogen springs have to be used. If possible use standard sizes.

Wire die springs are not allowed.


The respective fastening scheme for the gas springs of the same manufacturer shall be used.

Springs have to be equally arranged over the entire workspace.

When the die is fully opened no preload must exist on the cylinders.

Dimension (size, quantity, stroke) has to be calculated (Spring Diagram showing spring travel and load).

Cylinder travel to be 75 – 90% of maximum cylinder travel.

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All cylinders/springs must be fixed into the die shoe by individual screws or retainers.

All designs should be use standard catalog cylinder sizes. If longer rod extensions are necessary, transfer pins or kiss blocks (pre hardened steel) should be used between the stripper pad or blank holder / binder and the cylinder rod.

All draw, form and restrike stations need a manifold, or gas springs mounted on a common plate, and plumbed together with a pressure gauge.

Cylinders are to have self-aligning rods and dynamic lubrication system.

Nitrogen cylinders in the lower die are to have drain slots for drainage of liquids.

The minimum thickness from the bottom of the spring to the bottom of the casting need to be 30 mm.

Plumbed cylinders must use a minimum hose diameter of 10mm.

Manifold cylinder systems should utilize the non-breathing type of cylinder.

All manifolds and plumbed cylinders must have a gauge, quick release fill valve and drain valve (control panel) on the front of the die.

Operating pressure of each manifold to be stamped adjacent to gauge on the die shoe.

Data sheets are required on all manifolds.

4.6.2 Lifting and Handling

All dies to be equipped with eight (8) tapped holes for handling in accordance with the weight of the dies and positioned in order for the pick-up point on the crane to hold die at the center of gravity. Identify the hole size as metric or standard by either welding or machining an "M" or "S" next to each hole.

24mm - 300mm tapped holes are required for dies under 4,536kg and 36mm - 400mm tapped holes for dies 4,536kg and over.

80mm minimum hole depth.

The eight (8) holes consist of four (4) on each side, two (2) on top and two (2) on bottom. Thread size must be stamped beside holes.


Tie straps are required for locking the die for shipping.

These lifting holes to be standard threads even on metric dies. Thread size to be stamped beside holes.

Parts over 16kg (about 35 pounds) are equipped with tapped transport holes.

All sections heavier than 16kg (about 35 pound) to have handling hole to allow for removal of section by overhead hoist. Large sections must also have wedge slots to assist in loosening the section.

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Tooling components between lower parallels should be protected from damage with rigid blocks.

For EUROPE: Tool transportation is only done with load rings. They are to be adjusted to the weight. 4 load rings each are to be used. Each bolt ring has to be delivered with producer certificate. That's number has to be connected with producer certificate.



For USA/ Battle Creek: Tool weight may not exceed a total weight over 30 tons. The upper tool may not exceed 12 tons. The total weight of the tool must include parallels and change plates. Any die design that exceeds the weight requirement must be brought to ADIENT's attention. Resolution to the weight issue must be defined on the tool design review sign-off forms. Preliminary weight calculations on all tools must be provided at the first design review.

For USA/ Battle Creek: The tool must have two places between parallels wide enough for lift fork to carry or make special carrying handles on each end of the die. Exact dimensions and positions to be confirmed at design review.


For USA/ Athens: For ADIENT Athens plant dies that weigh over 4 tons should have fork lift access places 215mm wide and 95mm min height, spaced 432mm min to 1400mm max between centers.

For USA: Tooling components between lower parallels should be protected from damage with rigid blocks.

For USA: Identification of fork access points to be painted on the die shoe.

Markings at the tool show the crane operator the position of the QDC Locators so that the tools on the common plates can be placed precisely.

To avoid bending of the base plate during transportation tools have to be supported against each other.

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To ensure secure turning of the plates, edges are to be chamfered. (1/2"45 degrees/ 12mm – 45 Degrees).

In order to ensure a failure-free transport within the press, the attachment bar is fixed to the transfer bar.

For EUROPE: Tecarim blocks are used for tool storage. They are placed on tool spacers.

4.6.3 Additional Components

Bottom marker must be inserted in draw, form and post form / restrike tools.

Tube dies containing pierce punches must be provided with lubrication through the stripper pads with plumbing for pressurized oiling of punches.

Blank holders / binder are secured with retaining screws. Lock pins are not used.

Electrical system: no electrical system in the tool.

Coding according to coordination.

The transfer bars conduct 3 different movements (see press documentation) due to the press control:

1. Lifting
2. Closing
3. Feed

For EUROPE: Are two M16 threads each frontally installed at the lower / upper part at the parts outlet (last operation) to mount special equipment?

4.7 Information on the Die


It is possible to include the marking for all cast materials (e.g. GG25) in the casting process.

Heat-treated components must not be coated.

All tool details must be identified by detail number, material type and hardness. Die shoes must show detail number in the location of the detail.

The following information will be stamped on the die shoe:

- Vendors company name including address and phone number.
- Vendors job number to aid in ordering replacement sections.
- ADIENT/PS Tool Number (must obtain from ADIENT or PS who will receive tool)
- Part Number

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- Material thickness, width, and pitch
- Weight of upper die (identified on upper die)
- Total weight of die (identified on lower die)
- Outside shut height
- ADIENT Tool Identification number (TA)
- OEM Tool Asset/Tag Number (separate tag)

Material thinning must not exceed thinning limit per ADIENT Guide Line (see ADIENT specification).

Upper die shoe weight should be identified on the upper. Total die weight should be identified on the lower.

Stencil on two sides with 50 mm high letters. Stencil part number on upper die shoe. Stencil “Front Side” and “flow direction” on the die. Removable chutes must have the die number on them for tracking purposes.

All other manufactured parts have to be clearly marked as follows:

- Component reference (according to stock list)
- Material
- Hardening
- Weight (>25kg)


Before the tool is shipped to the ADIENT stamping facility or PS, identify the owner of the tool and provide the proper “Property of” plate on the tool.

All tools of a project are painted in specific RAL color determined by ADIENT.

All other elements are coated in the following colors:

Part	Color
Lower and upper part	Project color
Moving parts: Strippers, lifting plates etc.	RAL 1021 – yellow
Parts for blank holder spacers etc.	RAL 3001 – red
Parts not within the general dimensions (transportation parts)	RAL 3001 ó – black
Cover of stripper plate	RAL 3001 – red

Tabelle1: Painting Colours

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4.8 Press Installation

In general gas springs are to be used.

Neither lower nor upper air cushion shall be used.

Setting time is to be kept as low as possible to ensure good economic efficiency.

4.9 Tools

4.9.1 Transfer tools

4.9.1.1 Parallels and Plates

All transfer tools require lower change master plate.

Guidance pillars and blocks shall be arranged as close to the center of the traverse direction as possible to keep the dimensions of the tool small and the closing stroke of the transfer bar as short as possible.

4.9.1.2 Die Sections

The individual tools for transfer tools are designed as single die shoes. Keep draw tools separate from the common Plate, if possible due to Tonnage in balance it creates. It may cause burrs in the neighboring trim/pierce operation, if mounted on the same common plate.

4.9.1.3 Coil Feed and Guidance

Coil fed transfer dies require this feed up sensor at the last station fed by the coil feeder.

All coil fed dies must be designed and built with provisions for a fixed feed stop at the beginning of the die.

French notch/pitch notch requires a mechanical plunger with a micro switch.


4.9.1.4 Lifters

Lifters need to be designed to allow the part transfer system to repeatedly pick up the part to achieve the required SPM. Upper die ejectors should be vertically above the lower lifters so that the part lifts squarely.

Upper ejectors should have radii, so the part does not stick to them. Ejectors ((lower pin gas spring) must be able to be serviced in the press. (See Standard of assigned Press line for best lift fit concept)

4.9.1.5 Pilots

Pilot location are established during Strip/ Process lay out.

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4.9.1.6 Ramos Transfer

Must use Norggren receivers for automation.

4.9.2 Progression Tools

4.9.2.1 Design and Manufacturing Process

Minimum thickness for all Steel dies shoes shall be 75mm for lower die and 63mm for the upper die.

Each die set (sub-die) must have 4 guide pins with ball bearing guides. One post must be offset to avoid miss-assembly of the die.

All tools over 2438mm (about 96") or 300t must have bi-directional thrust blocks installed on the die set.

Tools with thrust caused by one sided forming will have extra heel blocks on the die set to offset the load. This is regardless to size and tonnage stated in 4.1.3. To be determined at the design review.

Tools with an off balanced forming load need to be centered under the ram.


Thrust blocks must have Ampco 21 or equivalent graphite impregnated Wear plates.

Position and design of trim bypass (intersection) are to be approved by ADIENT design department.

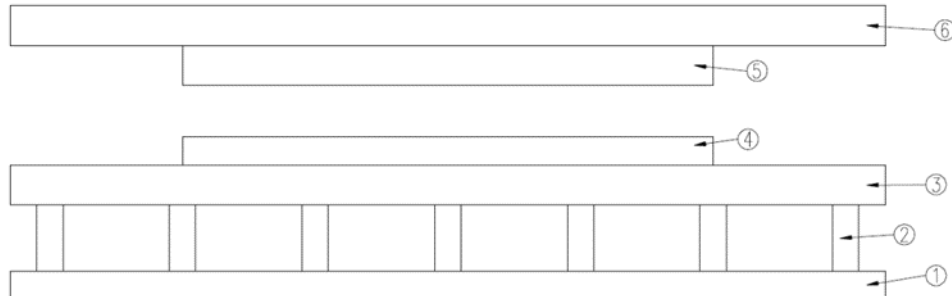
4.9.2.2 Tool dimension and Tonnage

Tooling tonnage requirement and tonnage and energy curve (lowest SPM at maximum Tonnage) calculations to be generated and issues during initial method plan review. Must include tonnage calculations from 150 deg. to 220 deg. (per assigned press line).

4.9.2.3 Parallels and Plates

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See picture below for minimum build up.



MINIMUM DIE BUILD UP DIMENSIONS

1	QDC plate	50,8mm (2" Transfer)
2	Paralells	Height TBD, Width: 50,8 mm (2")
3	Lower shoe	76,2mm (3")
4	Lower sub plate	50,8mm (2")
5	Upper sub plate	50,8mm (2")
6	Upper shoe	63,5mm (2,5")

Tool center lines to be identified on each main tool and each module section.

4.9.2.4 Die Sections

All complex cutting zones must contain die inserts that are removable to allow for die maintenance / regrind.

Form and restrike stages must be fully supported underneath, by means of casting of fabricated steel support.

4.9.2.5 Punches

Cutting and forming in the same stations not permitted.

Punch entry 6mm.

No welded punch and dies permitted.

No forming to be permitted by stripper facing (unless agreed by ADIENT Tooling Engineer).

All cutting into the side of the coil edge must have shouldered/heelled punch design.


All notching and forming punches that have any side thrust to be properly heelled.

Inserted trim punches to have hardened backing plates.

Pierce buttons to be keyed to prevent rotation.

Trim stations to be balanced or shear added to minimize cutting forces required.

All pierce punches (including notch punches) to have slug ejectors.

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Trim bypass (intersection) points to be added to strip layout and component cad model and issued to ADIENT design for approval.

French notch/ Pitch Notch (side of strip cut) for positive 1st pitch control and the use of positioning/finger stop is required. The finger stop should activate the sensor at this tool stage.

The pitch notch is to be used as the “first hit” indicator. If the “first hit” is other than the notches, a start line must be scribed in the die.

The first pilot hole needs to be pierced when the coil is against the pitch notch stop.

All trim station to be manufactured for easy sharpening and repair. Complex re-weld and cut back die designs must be avoided where possible.

Screw hole made deep enough to allow for regrind in any cutting stages (minimum 10mm).

4.9.2.6 Stamping

EUROPE/ Great Britain: A rotary stamp unit is required. Unit to be inserted into the lower tool, unless component drawing dictates otherwise. Unit to be removable/adjustable with the tool in press.

4.9.2.7 Coil Feed and Guidance

Coil feed shall be carried out with adjustable guide rails at rear of tool only.

The mark for the first cut is required to load the coil.

In the strip intake an inclined inlet is to be provided in feeding direction.

Front material entry guides to be made adjustable on rear guide only.

Off cuts are not permissible for the first cut to prevent parts remaining of the tool surface.

The components are separated from the strip and directed out of the press in the last step & fall directly onto the exit conveyor.


Component to exit via tool end and not through tool (unless agreed in writing by ADIENT AME).

For 2 out tools RH/LH parts must be separated at exit position.

All progressive dies must be designed and built with an end of die strip sensor (Misumi end of strip sensor), to verify that the strip has fed up completely without buckling in the die. The required sensor to be defined by the intended stamping facility before die buy-off.

Strip position sensing is mandatory for 1st pitch and last pitch before cut off (last pitch can use scrap or part for detection; to be approved by ADIENT AME).

Strip lifting between stations to be balanced.

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Upper tool stripper movement to be balanced.

Balance blocks to be used for upper stripper pad (balance blocks).

The strip needs to be centered in each step with the pilot. Ejector pins are to be placed beside the pilots.

The function "strip off" is integrated in the pilot unit.

Lateral gibs stock rails and guides are required to move the strip securely and with precise position through the tool.

All module intersection positions for gibs stock rails require an angled lead to guarantee material guidance between modules and prevent the possibility of collision.

Europe/ Great Britain: Stripper plate security by means of claw design with stripper bolts as secondary security stepped back 5 mm from claws.

4.9.2.8 Cams

Use commercial cam guide units if possible. Confirm type with ADIENT AME at design review.

Cam units to be BOB and have positive mechanical return. No home-made cams are permitted.

Aerial cams not allowed unless authorized in writing by ADIENT.

All cam trim and pierce units must be removable in the press.

All cams have to be depicted in retracted position.

Slug deflectors are required at cam pierce stages in die to prevent chain build up.

All cam drivers should be the width of the cam working area.

All cam stripper pads (bottom surface) must be a minimum of 1.5 x height of the cam.


All movable sections and cams must have grease fittings and grease grooves for proper lubrication.

Cams with wedge effect have to be monitored by proximity switches or have to be equipped with a forced retracting system.

Interlock cams have to be monitored in both positions by proximity switches.

Gag cams must be approved by ADIENT AME's at design. Must be able to operate gag outside the die or be air operated. It must be clearly marked so the operator can identify the part number at the location of the gag. Instructions must be in place if multiple gags are used.

Cams should be returned by nitrogen springs. A positive return should be added if possible, and if not a return sensor must be added. No finger type cam returns. Any cam systems without positive returns must be approved by ADIENT at design review.

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All trim lines with a 0.4mm profile tolerance on stretch bends, not in die plane, should be cam trimmed to achieve print tolerance. An adjustable coin block to increase capability of the trim edge without cams may be used on straight bends with no form.

4.9.2.9 Alignment

All modules to be individually guided by means of their own set of pillars and bushes (x4).

All guide pins and bushings to be demountable type.

Main guide pins/bushings to be ball cage type (positioning to be poka yoke).

Sub posts to be solid. Bushings to be lubrication free (positioning to be poka yoke).

Upper sub is to be used to guide/control stripper plate.

Tools with uneven or one-sided loads should use guide shoes (heel blocks) in addition to pillars and bushes. Heel block to be in working position a minimum of 300mm before pillars entry to bush.

4.9.2.10 Pilots

Component shall be located via pilot control at every tool stage in the scrap zones (strip web).

All pilot positions to have sufficient lower die clearance to prevent slug jam; hole through tool.

Additional pilot control will be required in the component (if component design permits additional tooling holes). Applies specifically for components with form that cause the strip to stretch or distort during forming operation.

A means of positively stripping the component from the pilots must be provided to prevent misfeeds from bound pilots (ejectors).

Strip or component pilot holes must not stretch or elongate during tool operation.

4.9.2.11 Scrap Discharge


Scrap exit via low friction stainless steel chutes. Single chute, no hinge point.

The scrap from the strip at this last stage should fall through the tool and onto the exit chute.

4.9.2.12 Safety Devices

Parking stops x4 required for each tool. Aluminum or Nylon preferred.

Setting/blow stops required for each tool and sub module.

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4.9.2.13 Springs and Nitrogenes

All draw/forming stages to use nitrogen gas springs. Mechanical springs are not permitted.

All gas spring pockets to contain drain holes.

Stripper gas springs must not have any preload.

4.9.2.14 Additional Components

Ready benders are to be considered for straight line bends.

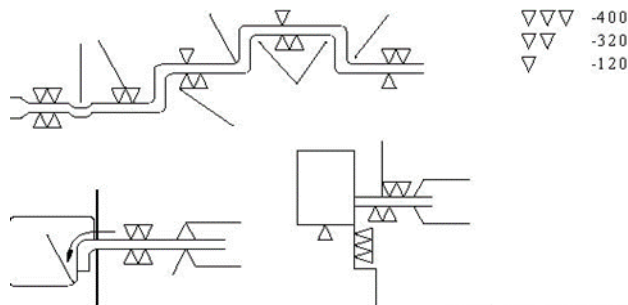
Any changeover elements for component variants, to be clearly identified and poka yoke.

Information on the die weight mark required for complex form components to ensure tool weight is correctly set.


4.9.3 Drawing Tools

4.9.3.11 Design and Manufacturing Process

Single acting draw tool: The blank of the draw tool (single) is locked between blank holder (lower part) and forming die (upper part) the blank holder performs a predetermined stroke. Then blank is drawn over the draw punch. Basically, the drawing punches, blank holders and female die have to be segmented.



Note: All Forming Pads (marked

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DIE TYPE	OPERATING AREA	MINIMUM POLISHING GRIT	Bearing / Spot in %
DRAW	RADIUS	400	90
	FORMING SURFACES	320	90
	GENERAL SURFACES	120	N/A
RESTRIKE & FLANGE	RADIUS	400	90
	FORMING SURFACES	320	90
	GENERAL SURFACES	120	N/A
TRIM & PIERCE	HOLDING SURFACES	320	70
	TRIM EDGE	320	N/A
	WALLS & CUTTING EDGE	120	N/A
	GENERAL SURFACES		N/A
ALL DIES	GUIDING SURFACES (AND BETTER)	320(400)	N/A


A later coating of the segments is to be taken into consideration.

4.9.3.2 Drawing sections

Blank holder / binders are required for areas where the part is likely to wrinkle or overlap when formed. Blank holder / binders must have nitrogen springs (individual cylinders or manifold) plumbed to a common gauge with charge valve and min. 5mm hoses. Bolts and dowels must not extend into the working area of the draw pads. Adequate gauging must be provided to locate the part correctly into the draw station before it is gripped by the blank holder / binder / ring.

The contact surface to the blank of blank holder / binder / ring, punch and cavity must be hand finished to compensate for material thickening (SEE TABLE).

Any draw beads and binder stand-offs must be shim adjustable in the press.

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All forming areas have to be equipped with tool steel inserts.

Design of steel inserts:

- The blank holder / binders are equipped with steel inserts and are to be secured against thrust. Tool steel inserts are to be bolted from above, outside of the working areas (blank perimeter).
- It is to be decided in advance if a riser plate of 5 mm is mounted below / behind the steel inserts.
- To ensure that the finished component remains on the blank holder, the tool cavity is to be equipped with push-off pins and vent holes.

Design cast part: (Exception)

- The tool cavity is bolted to the upper part and cross keyed, and doweled.
- This is to be coordinated with the stamping facility.
- If required for long and slim components (e.g. longitudinal beam members) it is possible to integrate safety against fracture in the tool cavity.
 - Option 1: split cavity, cross keyed and bolted, with lock keys on blank holder / binder to prevent the cavity spread.
 - Option 2: Tie rods for split cavity.

4.9.3.3. Drawing punches

The draw punch is equipped with steel tool steel inserts.

It is bolted to the lower shoe and cross keyed, and doweled.

The blank holder / binder is guided at the lower shoe parameter with wear plates.


In exceptional cases it is also possible to use the punch as a guide, this is to be coordinated with the stamping facility.

4.9.3.4 Coil Feed and Guidance

Rough locator is used to locate part in draw station.

Minimum of 25 mm lead in.

Blank holder / binder: Part sensing is done in transfer. Nitro cylinders is to be connected using a manifold.

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Gas springs plumbed together with control gauges, mounted on a common plate is acceptable.

4.9.4 Lifters

If lifters are required, they have to be operated pneumatically and disassembly from above is to be ensured.

Lifter design is always round / oval.

4.9.5. Additional Components

Balance blocks between blank holder / binder and tool cavity are to be positioned above the gas spring.

4.10. Trim Tools

4.10.1 Design and Manufacturing Process

The trim clearance is by default 10 % of material thickness, deviations must be requested from ADIENT.

The punch entry and vertical land on lower trim steels is ca. 6mm. With a .5-degree taper relief.

4.10.2 Materials

Cutting attachments are not permitted.

For material see ADIENT Comparison Sheet.

The stripper plate may possibly be omitted, due to lack of space, must be requested from ADIENT.

4.10.3 Cutting and Forming Sections

Cutting and forming on the same section requires written approval by ADIENT. GTS must clearly identify during design review phase, and are responsible for obtaining written approval from ADIENT.

3-D cutting sections must be avoided. If approved by ADIENT in the design review, CAD surface models must be provided after buy-off at the GTS.


The trim steel length shall not exceed 250 mm.

No cutting steels to be larger than 250mm x 250mm without ADIENT approval. Trim steel(s) must not exceed 15kg (about 35lb) per section.

Ejector pins for slugs are to be use for cam cutting.

Standard cams are to be used. Self-made cams are not permissible.

In case holes are to close at the trim edge, pierce / trim inserts have to be used.

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In order to ensure quick repair, cutting inserts have to be used for areas with an extreme risk of breakage or with high wear.

All trim steels must be removable inserts to allow for sharpening and replacing in the press. All sections must be mounted to steel plate.

All cutting and form sections are to be bolt & dowel replaceable with 100% cad data and dimensioned 2D drawings to be supplied by Global Tooling Integrator.

All sections are to have the bolt & dowel patterns off-set to prevent the section being installed improperly.

Dowels in an individual section must all be the same size.

Dowels should be press fit into die shoe and slip fit into sections. Provide through hole to remove dowel pins. Absolutely no blind dowel holes.

Bolted sections and punches should have threaded jack screw holes between or adjacent to the dowels. Extractor threads should be the same size as the retaining bolts in that section.

Larger sections must be keyed for greater support and ease of locating.

All form or cutting steels welded during the die development must be replaced by the GTS in time for the ADIENT/CM plant buy-off.

All trimming or piercing less than 25mm x 25mm sections or holes punches, stripper access window, etc. must be removable in the press.

If trim steels have to be dismantled to be able to remove blank holder or cam they have to be marked with an X and a sign indicating on a visible position.

All one sided trims must be heeled, with the heel entering the die before the punch contacts the material. Heel blocks must not be steel on steel, Ampco type material must be used on one face. Heel blocks must be keyed to die shoe. Lower sections must be cross keyed or be pocketed on the opposite side of trim area. Deviations require ADIENT sign off and approval.

Form steels working with offset loads must be heeled on the opposite side of the die shoe. Heel area must engage before forming starts. Heel blocks must not be steel on steel. Dissimilar material must be used on at least one face. Heel blocks (Ratio: 1:1.5) must be keyed to the die shoe and/or pocketed.


If the product design requires a trim line or hole out of the die plane to maintain a profile / true position tolerance of 0,4mm, or less, cams will be required after the part has been fully formed. If cam trimming or piercing is not feasible or creates a weak die condition, alternate solutions must be approved by ADIENT in writing or product changes must be proposed and approved. This must be agreed upon and signed off during design reviews.

The principle "Trim Tang" means that small straps are cut and formed in the component

4.10.4. Cutting Punches

Piercing punch and piercing buttons / bushings are standard purchased parts and can be ordered any time.

Pierce punch length should be 80mm.

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The piercing punch diameter is determined by the method. The following is valid for ADIENT: 75% of upper tolerance.

Piercing bushing is mounted in retaining plate of bushing.

Exchange of piercing punches within the press has to be ensured.

Trim punches must be heeled in opposite direction of cutting force add.

Piercing buttons are inserted in retaining plates respectively trim details.

Piercing punches and bushings with shape are to be secured against twisting.

Exchange of piercing punches within the press has to be ensured.

4.10.5 Strippers

If there are problems due to lack of space, the stripper plate may possibly be omitted.

4.10.6 Alignment

Cutting and piercing tool are to be generally guided with guidance pillars.

4.11 Postforming/ Restrike Tools

4.11.1 Design and Manufacturing Process

All post forming tools are named calibration restrike, edging and/or collaring dies.

4.11.2 Parallels and Plates


A stable structure is especially to be considered because high shearing forces may occur.

4.11.3 Die Section

Form tool steel inserts are to be made of steel and generally secured against shear strain (cast shoulder).

Generally shouldered or welded tool steel inserts, no attachments. Coating if required.

Form tool steel inserts are cross-type screw fitted.

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4.11.4 Coil Feed and Guidance

Blank holder can be guided with guidance pillars and/or sliding plates.

Blank holder require in general clearance to the lower part.

If possible the blank holder should be made of GGG50 (see ADIENT Comparison).

Blank holders are operated via gas spring. The required force and stroke is to be calculated. Based on this, quantity and size of gas spring is determined.

Blank holders are secured with retaining screws. Lock pins are not used. Quantity and dimension of the retaining elements are to be adjusted to the weight and press speed. Retaining screws and standard parts consist of spacer tube, washer and damper (heavy load). Attention: Safety elements!!!

A gas spring is required above the spacer. Spacers in the lower part are placed on a foundry rib.

Cone locations are used for outer skin parts and areal in the blank holder (sleeve slide).

4.11.5 Alignment

As a default bronze with solid lubricant according to DIN are to be used.

Since high lateral forces can occur in post forming tools, sufficient absorption of shear is to be considered.

Since guidance pillars cannot absorb lateral forces, sufficiently dimensioned support blocks are to be implemented.

4.11.6 Additional Components

Adaptor plates are only used for restrike die, or if this is required.


Adaptor plates are at least 5mm thick and are bolted with counter sunk screws (at least 2x) to the tool steel inserts.

Tuning plates provided with chamfer. Attention must not lie on the cast corner (milling radius) and should be all around min. 1mm smaller than the area on which they are screwed.

Scrapers can be used for edging tools in order to remove the component from the form.

Hardeness Chart:

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ELEMENTS	MATERIAL	Surface Treatment / HARDNESS
Cut and trim elements (punch, plate, bush) non-standardized	1. 2379 or PM-steel	Hardened HRC 58-60
Bending elements (males and females)	1. 2379 or PM-steel	Hardened HRC 56-58
Critical parts (with possible wearout problems)	1. 2379 or PM-steel	PVD, TICTIN
Structure parts without main function	GC25 or ST37/52	-
Structure parts with main function	GGG-70	-
Stripper plates (draw tools) for large tools	GS-45 or GS-60	-
Draw elements, stripper plates (contact with sheet metal)	1.2379 or PM-steel	Hardened HRC 57-60
Draw elements, stripper plates (contact with sheet metal) for big volume or very thick	1.2379 or PM-steel	Hardened HRC 57-60
Guides for console (centering press)	1.2379 or PM-steel	Hardened HRC 57-60
Guide ejectors, punch plates, bush plates	1.2379 or PM-steel	Hardened HRC 57-60
Stripper plate covers (contact with sheet metal)	1.2379 or PM-steel	Hardened HRC 57-60
Chutes	Stainless steel channeled sheet	-
Flat guide bars	Bronze with non-liquid lubricant	One side bronze, the other side hardened

Tool steel and heat treatment must be confirmed with the AME tooling engineer (For components with a yield strength of more than 800 N/mm²).

The head treatment and coating for PM steels must be confirmed with AME tooling.


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4.12 Additional Specifications and Standards (on going)

Document name	Documents are valid for EU / NA	Description
For all the documents listed below:	EU /NA	The supplier must request the documents from ADIENT Tooling Engineer
ADIENT Tooling standards (Template_Technical_Standards) ADIENT_Global_Tooling_standards_2017-02-14-rev-01	EU	Template for progress report (summary page)
Runoff package rev 1-7-11	NA	Work book for tooling
ADIENT increment formability simulation ADIENT Incremental Formability Simulation Template-rev.01 or ADIENT_SimReport_Template-rev-001	EU / NA / CN	PowerPoint template for summary of simulation results / Autoform template for summary of simulation results.
ADIENT_Checkliste_Tool PROJECT_PART-NO_CHECKLISTE_TOOL_YYYYMMDD-rev-01 (19.01.2017)	EU	Template for: method plan, construction, decrease supplier, documentaion operation, documents
ADIENT_Feasibility_Checklist PROJECT_PART-NO_Feasibility_Commitment_press_parts_YYYYMMDD-rev-01	EU	Template for: feasibility, oil, marked up drawing
ADIENT_Relief_Notch_Approval_form PROJECT_PART-NO_Notch Approval form_YYYYMMDD-rev-01	EU / NA / NC	Template for: All information about notches
ADIENT_Tool_Data_Sheet PROJECT_PART-NO_Tool_Data_Sheet_YYYYMMDD-rev-01	EU / NA	Template for: Tool Data Sheet
ADIENT_Tooltracker PROJECT_PART-NO_Tooltracker_YYYYMMDD-rev-01	EU	Template for: Tooltracker
INTERNAL-Press-specification-rev-01 (Siemianowice and Lahnwerk) INTERNAL-Press-specification (Alagon, in progress) INTERNAL-Press-specification-2016-12-02-rev-01	EU	Dimensions of presses and tools, characteristics of presses, values.

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Transfer_specification_ 2016-12-01-rev-01 Transfer_specification_2016-12-01-rev-01	EU	All information about transfer.
Process concept-rev-001 Process concept-rev-001-1	EU /NA / NC	Template for process
RFQ-tool-spec-rev-001 RFQ-tool-spec-rev-001	EU	Template for RFQ tooling
ADX Portal	EU	Server used for Data exchange

4.13 Abbreviations

AME Advanced Manufacturing Engineer

BH blank holder

BOM bill of materials

CAD computer aided design

CC critical characteristics

CM customer

CMM Coordinate Measuring Machine

cpk capability process index

GTS global tooling supplier


i.e. that is

IC Inspection Characteristics

KN KEIPER Standard

Max. Maximum

Min. Minimum

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MSA Measurement system analysis

n/a not available

PS part suppliers

PS press shop

PSW ?

P.O. purchasing order

QA Quality assurance

QDC plates ?

RFQ request for quotations

SMP strokes per minute

SC significant characteristic

tbd. to be defined

var. / v variable

ZB Assembly unit

PM steel powder metallurgical steel