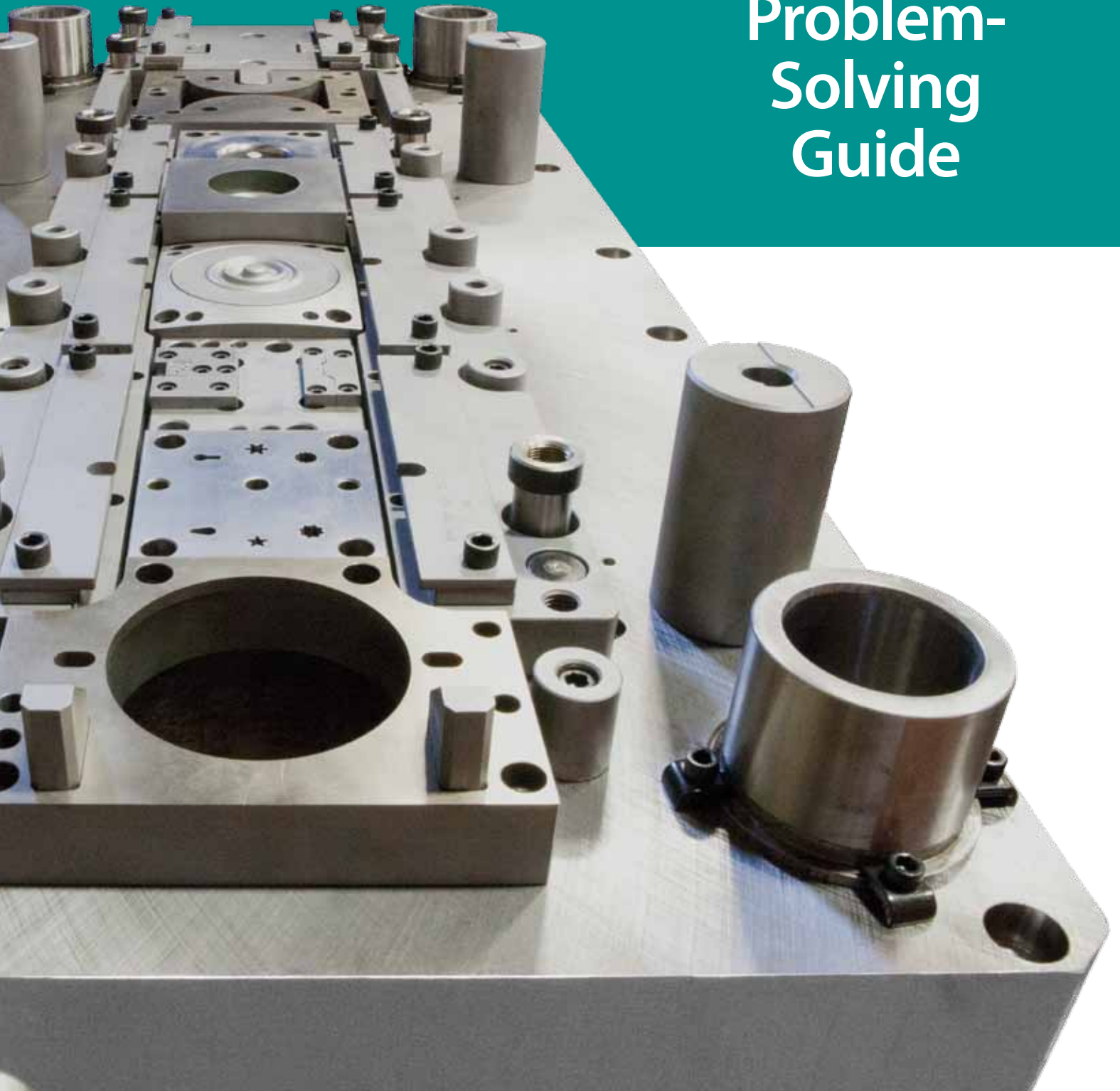


Problem-Solving Guide



Metal Stamping Solutions

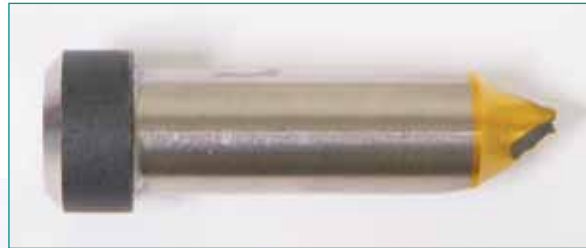


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Common Stamping Problems

Manufacturers know that punching can be the most cost-effective process for making holes in strip or sheet metal. However, as the part material increases in hardness to accommodate longer or more demanding runs, greater force is placed on the punch and the die button, resulting in sudden shock, excessive wear, high compressive loading, and fatigue-related failures.

The results of some of these problems are shown in the photos on this page.



Punch Chipping & Point Breakage

Chips and breaks can be caused by press deflection, improper punch materials, excessive stripping force, and inadequate heat treatment.

Slug Jamming

Slug jamming is often the result of improper die design, worn-out die parts, or obstruction in the slug relief hole.

Slug Pulling

Slug pulling occurs when the slug sticks to the punch face upon withdrawal and comes out of the lower die button.

Punch Wear and/or Galling

Die performance and longevity can be improved through the use of regular maintenance, as well as the use of lubricants and leading edge punch designs.

Punch Head Breakage

Punch deflection leads to punch head breakage. Cutting shear, press tonnage, the type of backing plate, alignment, and the types of punches and retainers all require careful consideration when designing a punch.



This booklet deals with several common punching problems; presents some likely causes; and, offers solutions to these problems—including Dayton products.

Troubleshooting Guide to Extending Punch Life, Improving Performance, & Reducing Downtime

Solutions for punch wear, breakage, and other problems come from both time-tested techniques (e.g., adding a larger-than-normal radius under the head) as well as consideration for a wide range of leading-edge engineering solutions (e.g., head alterations) and specialty coatings designed to maximize the life of the punch.

This troubleshooting guide can help you determine the cause for your broken, chipped, or worn punches. It can also help you select the best solution—including Dayton products and services.

Dayton TuffPunch® Punches eliminate the lateral shock that would otherwise put stress on the outer edge of the head.



Problem: Punch Chipping & Point Breakage

Cause	Solution	Dayton Products & Services
High impact or compressive failure	Change punch materials	Consider Dayton Versatile M2 & PS4, Ball Lock PS4, or TuffPunch® PS4
	Change to a larger body diameter punch	
	Change from a Jektole® to solid punch	
	Use guide bushings	Consider Dayton Versatile product line
Misalignment resulting in lateral forces	Check for worn guide pins & bushings—replace, if necessary	
	Check for loose gibs in the ram of the press	
	Check overall die alignment	
Part material movement	Use gas or spring-guided stripper	Consider Dayton MaxLife® Die Springs
	Use a retainer or punch-mounted stripper	Consider Dayton DAYStrip® or SMARTStrip™ Urethane Strippers
Poor material control	Review die, press, & feeder setup	
Excessive stripping force	Increase punch-to-die button clearance	Ref. "The Engineered Clearance" & Dayton clearance testing service
	Reduce punch-to-die entry	
	Consider coatings to add lubricity	Ref. Dayton coatings brochure
	Back taper on punch point "B"	
Punch point hardness too low	Polish punch point	Consider Dayton Versa/plus™ products
	Verify hardness is minimum of 60 RC	Request technical assistance from Dayton to insure proper RC hardness
Punch point "B" too long	Increase punch-to-die button clearance	Contact Dayton Regional Manager
Improper punch material selected	Change punch material	Consider Dayton Versatile M2 & PS4, Ball Lock PS4, or TuffPunch® PS4—use technical assistance request form
Sharpening damage	Use flood coolant and proper sharpening techniques	
	Use correct speed & feed for grinding wheel—correct grinding wheel for steel type	
	Remove regrind burr—break sharp corners on punch face	
Regrind burr	Remove regrind burr—break sharp corners on punch face	
	Increase clearance	Ref. "The Engineered Clearance" & Dayton clearance testing service
	Change punch material	Consider Dayton Versatile PS or PS4, Ball Lock PS4, TuffPunch® PS4, or Versa/plus™ punch
	Coatings/surface treatments	Ref. Dayton coatings brochure
Tight die clearance	Use guided stripper	
	Increase clearance in the corners of die button	Consider Dayton "L" or "K" punch
Flat punch face	Use shear angles	Consider Dayton XS20 or XS21 on round & shaped punches
	Engineered edge break	
Improper heat treatment	Check catalog RC specification	Use technical assistance request form for metallurgical heat treat check
	Triple tempered for high-speed tool steels	Dayton's in-house heat treatment monitored by staff metallurgist
	Cryogenics	Dayton's in-house heat treatment monitored by staff metallurgist
Punch RC wrong for application	Lower RC hardness	Contact Dayton Regional Manager
Improper punch stagger	Stagger should be less than the burnish length of the part material	Contact Dayton Regional Manager
	Cut-off operation & large point punches first to enter	
Improper finish on punch point and/or punch face	Insure there are no harsh grinding or turn marks on the punch point and/or punch face	Contact Dayton Regional Manager
Grinding burn on punch point	Purchase punches from ISO certified source	
Part material above 8,500 PSI	Change punch material	Consider Dayton Versatile PS4, Ball Lock PS4, TuffPunch® PS4, or EVERLast™ technology

Problem: Slug Jamming

Cause	Solution	Dayton Products & Services
Tight die clearance	Increase die clearance	Ref. "The Engineered Clearance" & Dayton clearance testing service
Excessive land length	Reduce land to 1-4 times stock thickness	Consider Dayton XB alteration
	Change relief from counter bore to taper	Consider Dayton Versatile & Kommercial Die Buttons
Taper in the land of the die button	Verify there is no reverse taper in the land of the die button	
Inadequate taper relief in die button	Increase per side taper	Consider Dayton XAR alteration
Worn die button	Sharpen, replace, and/or change die button material	Consider Dayton M2 or Versatile PS
Worn or chipped punch	Sharpen or replace punch	
Rough land in die button	Use die buttons with smooth wire cut, or ground land	
	Use shear angle on punch and/or check punch-to-die alignment	Consider Dayton XS20 or XS21 on round or shaped punches
Slug tipping	Check lubrication—consider lubricating both sides of part material	
	Use a Jektole® punch with a side vent hole	Consider Dayton patented Jektole® punch
Obstruction in slug relief hole	Examine slug path	
	Consider increasing the size of the relief hole in lower plate	Contact Dayton Regional Manager

Problem: Slug Pulling

Cause	Solution	Dayton Products & Services
Bellmouth wear in die button	Increase die clearance	Ref. "The Engineered Clearance" & Dayton clearance testing service
	Check alignment	
	Change die button material	Consider Dayton M2 or Versatile PS
Punch entry too deep	Use slug control system	Consider Dayton XSC slug control
	Reduce punch entry	Contact Dayton Regional Manager
Punch entry not deep enough	Increase punch entry	Contact Dayton Regional Manager
Excessive die clearance	Reduce die clearance	Ref. "The Engineered Clearance" & Dayton clearance testing service
	Use a Jektole® punch with a side vent hole	Consider Dayton's patented Jektole® punch
Slug not held in the land	Use slug control system	Consider Dayton XSC slug control
	Use vacuum slug sucker	
	Blow air through center hole in punch	Consider Dayton XK alteration
	Check lubrication	
Not enough relief on die button	Demagnetize punch	
	Use negative taper in land	
	Rough up land	
	Bellmouth the cutting edge of the die button	Consider Dayton form die button W910 & W920
Not enough relief on die button	Increase taper relief or use counter bore die button	Consider Dayton XAR alteration

Improving Punch Performance

The formula to the right can help you determine the perforating force required to obtain optimum performance from your punches.

In the example, the shear strength of the part material (S) is 38,500 PSI. In the "Press Force Requirement" chart on the right, you can see that the material required is 1010 Cold Rolled Steel.

Perforating Pressure Formula

$$P = T \times L \times S$$

T = Thickness of Part Material

L = Length of Shear (Pi x Dia = Circumference)

S = Shear Strength of Part Material

P = Perforating Force

Example

$$T = .062"$$

$$L = .5" \text{ Diameter} (3.14159 \times .5 = 1.5708)$$

$$S = 38,500$$

$$P = .062 \times 1.5708 \times 38,500$$

$$P = 3,749.5 \text{ Lbs.}$$

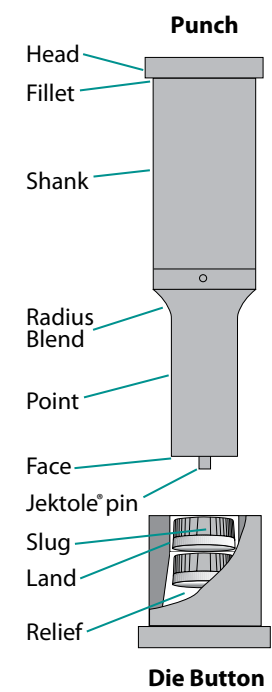
Problem: Punch Wear and/or Galling

Cause	Solution	Dayton Products & Services
Tight die clearance	Increase die clearance	Ref. "The Engineered Clearance" & Dayton clearance testing service
	Coatings/surface treatments	Ref. Dayton coatings brochure
	Change punch materials	Consider Dayton Versatile M2 & PS4, Ball Lock PS4, TuffPunch® PS4, or Versa/plus™
Punch entry too deep	Reduce punch entry	
Misalignment	Check die & press alignment	
Regrind burr	Remove regrind burr—break sharp corners on punch face	
Improper sharpening of punch	Use flood coolant, and correct grinding wheel speed & feed for steel type	
Improper punch material	Change punch materials	Consider Dayton Versatile M2 & PS4, Ball Lock PS4, TuffPunch® PS4, or Versa/plus™
Sharp corners on shaped punches	Increase clearance in the corners of the die button	Consider Dayton "L" or "K" punches
Punch surface too rough	Consider punch finish improvements	Contact Dayton Regional Manager
Lack of lubrication on part and/or incorrect lubrication	Check lubrication	
Prepainted & coated part material	Increase die clearance to accommodate powdering & flaking	

Problem: Punch Head Breakage

Cause	Solution	Dayton Products & Services
Punch pumping	Verify head thickness is properly fit in the retainer counter-bore	Consider Dayton "TT" alteration
Insufficient chamfer in retainer	Chamfer retainer to clear head fillet on punch	
Backing plate too hard	Draw back backing plate to reduce hardness—RC 40-50	
Head is too hard	Draw back head of punch to lower RC	Consider Dayton draw heads RC 40-55
High impact or high compressive load on head	Use shear angle on punch point	Consider Dayton XS20 or XS21 on round or shaped punches
	Increase head diameter and thickness	Consider Dayton TuffPunch® products
	Increase shank diameter	
Radius under head too small	Minimum radius should be .010	

The drawing below provides a quick reference to the various parts of a punch die set, i.e., the punch and the die button (the receptor).



For additional information on tool steels, coatings, clearances, forces on the punch, and guidelines for the selecting the best product for your operation, contact your local Dayton Progress representative.

This publication is part of a series of free technical self-study and classroom courses designed to improve your knowledge of the metal stamping process. Other types of Dayton technical assistance include person-to-person consulting, online and printed catalogs, CAD-compatible design software, and other materials and programs.



Press Force Requirement

Material	Shear Strength (PSI)	Material	Compressive Strength (PSI)	60% PSI
Aluminum	12000	A2	305,000 @ RC 60	183,000
Copper	23000	D2	320,000 @ RC 60	192,000
Brass	30000	M2	375,000 @ RC 62	225,000
1010 CRS	45000	M4	425,000 @ RC 63	255,000
Stainless Steel	85000	CPM 10V	400,000 @ RC 63	240,000

In addition to shear strength and material requirements, you may need to calculate the SBR (Straight Before Radius), the LRB (Length of the Radius Blend), the PSI on the punch head, and other numbers.

Dayton Progress maintains a selection of interactive formulas that can be easily populated and used to obtain this and other information.

For access to these formulas, simply contact your nearest Dayton representative.

Dayton Progress Corporation
500 Progress Road
P.O. Box 39
Dayton, OH 45449-0039 USA

Dayton Progress Detroit
34488 Doreka Dr.
Fraser, MI 48026

Dayton Progress Portland
1314 Meridian St.
Portland, IN 47371 USA

Dayton Progress Canada, Ltd.
861 Rowntree Dairy Road
Woodbridge, Ontario L4L 5W3

Dayton Progress Mexico, S. de R.L. de C.V.
Access II Number 5, Warehouse 9
Benito Juarez Industrial Park
Querétaro, Qro. Mexico 76130

Dayton Progress, Ltd.
G1 Holly Farm Business Park
Honiley, Kenilworth
Warwickshire CV8 1NP UK

Dayton Progress Corporation of Japan
2-7-35 Hashimotodai, Midori-Ku
Sagamihara-Shi, Kanagawa-Ken
252-0132 Japan

Dayton Progress GmbH
Adenauerallee 2
61440 Oberursel/TS, Germany

Dayton Progress Perfuradores Lda
Zona Industrial de Casal da Areia Lote 17
Cós, 2460-392 Alcobaca, Portugal

Dayton Progress SAS
105 Avenue de l'Épinette
BP 128
Zone Industrielle
77107 Meaux Cedex, France

Dayton Progress Czech sro
Hala G
Pražská 707
CZ-294 71 Benátky nad Jizerou
Czech Republic



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