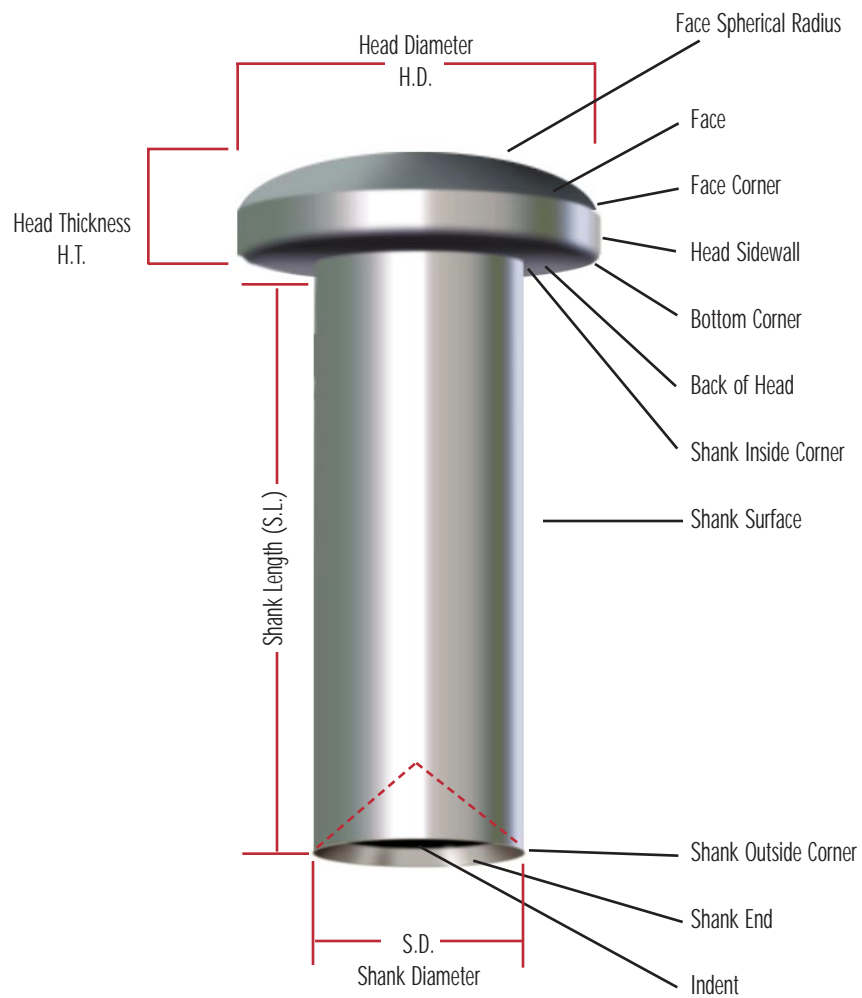
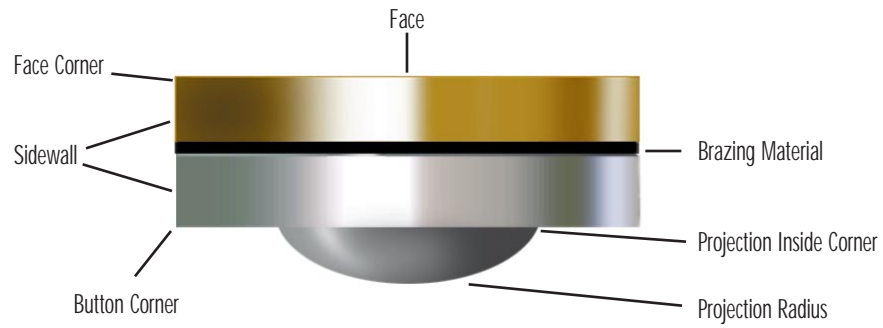


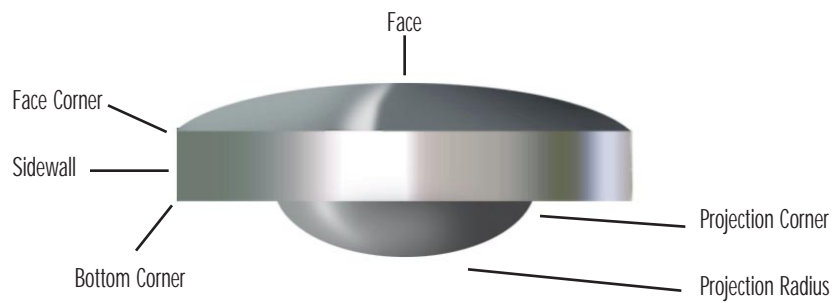
Rivet Contact



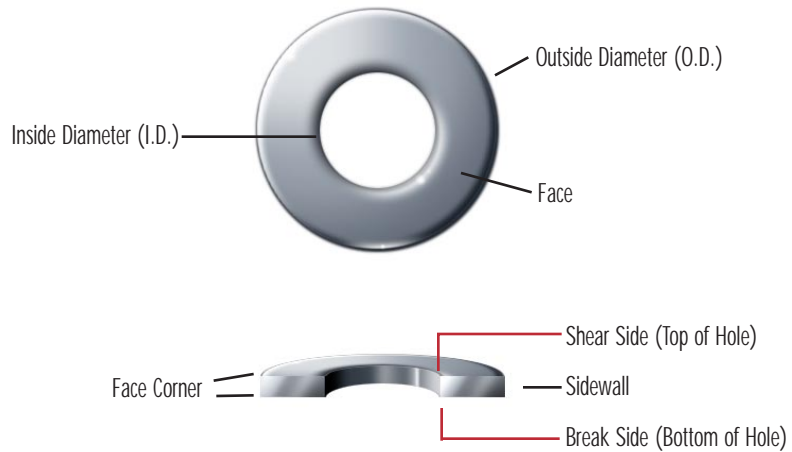
Braze/Coin Weld Button



Solid Weld Button



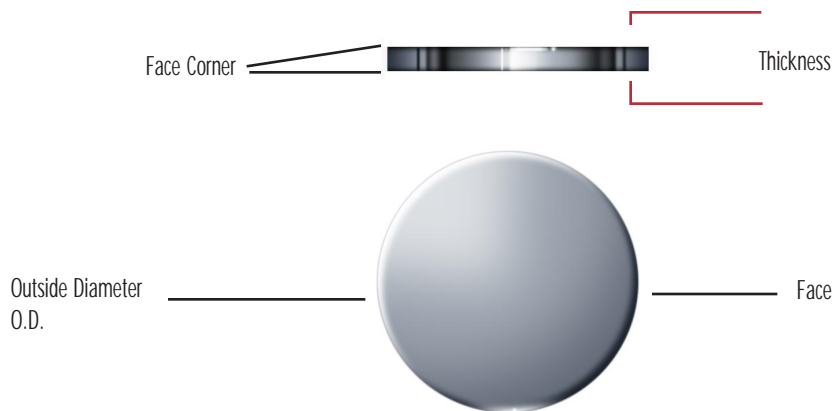
Tungsten Ventilated Disc



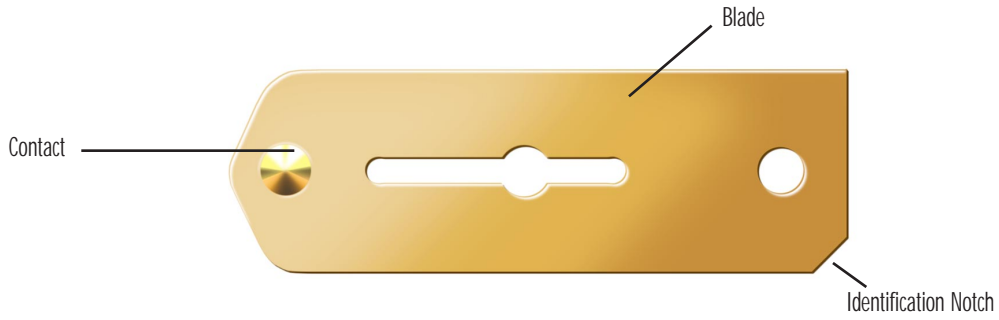
Tungsten Forged Disc



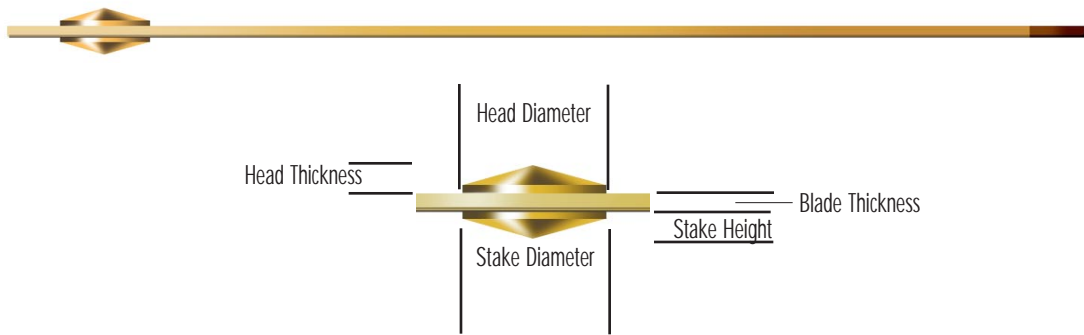
Tungsten Flat Disc



Blade Assembly



Contact Stake Assembly



Contact Tape Weld Assembly



Rivet Contact - Process Variation Descriptions

Excessive Fillet

Potential Problem

Can cause air gaps

Checking Method

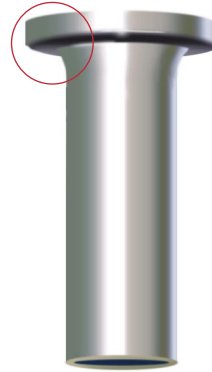
Optical Comparator

Control Method

Quantify maximum radius

Cannot exceed .005R; can cause air gaps

ref: Page 22



Blisters, Flaking and Loose Material

Potential Problem

Can cause potential short problems

Checking Method

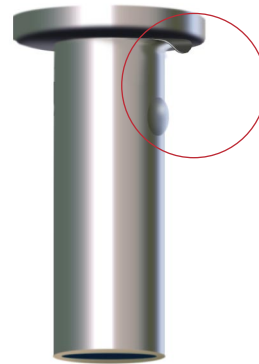
Visual with Eye Loop

Control Method

Specify "loose/flaking" material - not permissible

Can cause braze quality problems & switch failures

ref: Page 18



Flash or Spill Over

Potential Problem

Can cause feeding problems

Checking Method

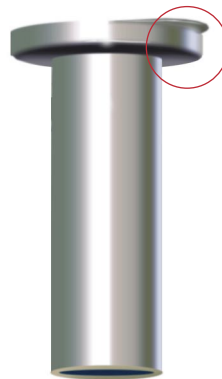
Optical Comparator

Control Method

Specify maximum flash

Cannot exceed .001 in width or length; can cause feeding problems

ref: Page 21



Breakout at Shank

Potential Problem

Can cause air gaps

Checking Method

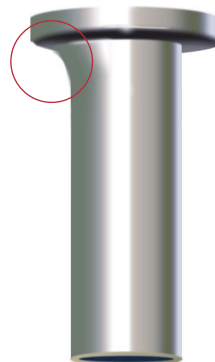
Optical Comparator

Control Method

Quantify maximum radius (Same as Excessive Fillet above)

Cannot exceed .005R; can cause air gaps

ref: Page 22



Rivet Contact - Process Variation Descriptions

Head Sidewell not filled in

Potential Problem

Cosmetic; may cause bowl/track feeding problems

Checking Method

Optical Comparator

Control Method

Specify minimum straight sidewall

Should be filled in for 360 degrees and cover 3/4 of head thickness

ref: Page 22



Void on Face Corner

Potential Problem

Cosmetic; may cause piggyback feeding problem

Checking Method

Optical Comparator

Control Method

Specify maximum corner break

(EX: H.D. = .100 Max void or radius = .005)

Check on optical comparator; could cause piggyback feeding problem

ref: Page 21



Shear

Potential Problems

Cosmetic; may cause bowl/track feeding problems

Checking Method

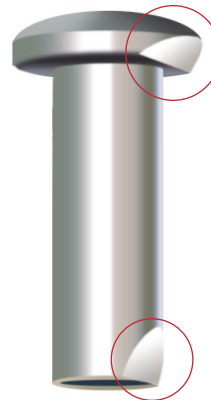
Optical Comparator

Control Method

Specify maximum face corner break

Can cause air gap and assembly problems; REJECT

ref: Page 23



Tool Marks on Shank

Potential Problem

Can cause air gaps

Checking Method

Surface Finish Tester

Control Method

Specify maximum surface roughness

Deep dig in marks no-good; light finger drag OK

ref: Page 22



Rivet Contact - Process Variation Descriptions

Shank end not square

Potential Problem

Can cause staking problems

Checking Method

Optical Comparator

Control Method

Specify squareness

*Shank Length = must be within print tolerance at all points;
could cause staking problems*

ref: Page 22



Hammer Mark

Potential Problem

Cosmetic; may cause alignment problems

Checking Method

Optical Comparator

Control Method

Specify maximum percentage of head diameter

Reject if it exceeds 5% of head diameter

Ex: .001 H.D. = .005 Max

ref: Page 21



Tail on chamfer

Potential Problem

Can cause loose material and potential shorts

Checking Method

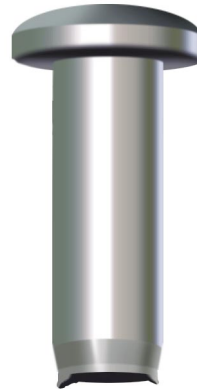
Visual and Eye Loop

Control Method

Specify maximum burr

Must not exceed .001 burr/flash allowance

ref: Page 22



Oversized Shank Diameter

Potential Problem

May cause assembly problems

Checking Method

Micrometer

Control Method

B/P tolerance (Point of wear is directly under head)

Point of greatest wear is under head; measure with mic for 360 degrees

ref: Page 22



Rivet Contact - Process Variation Descriptions

Poor Concentricity Between Head and Shank

Potential Problem

Assembly alignment problems

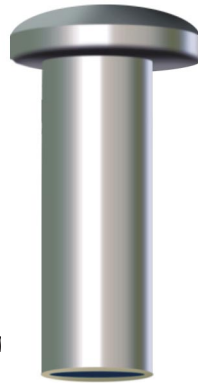
Checking Method

Spindle Fixture and Optical Comparator

Control Method

Specify maximum T.I.R. between head and shank

*Check with zero spindle and optical comparator; can cause assembly alignment problem
ref: Page 21*



Shank not Square

Potential Problem

Can cause staking assembly problems

Checking Method

Optical Comparator

Control Method

Specify head to shank squareness

*Check on optical comparator; could cause assembly and staking problems
ref: Page 22*



Sidewall not Straight

Potential Problem

Can cause piggy back feeding problems

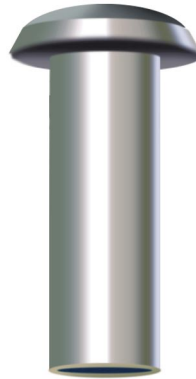
Checking Method

Optical Comparator

Control Method

Specify minimum sidewall straightness

*Check on optical comparator;
could cause piggyback and auto assembly problems.
ref: Page 22*



Face Radius not uniform

Potential Problem

Cosmetic; possible life cycle reduction

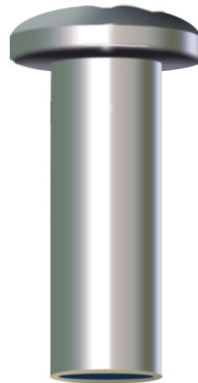
Checking Method

Optical Comparator

Control Method

Specify minimum percentage of uniformity

*Uniformity applies to 75% area only. Check on optical comparator
ref: Page 21*



Rivet Contact - Process Variation Descriptions

Hole Depth Undersize

Potential Problem

Can cause assembly problems in staking

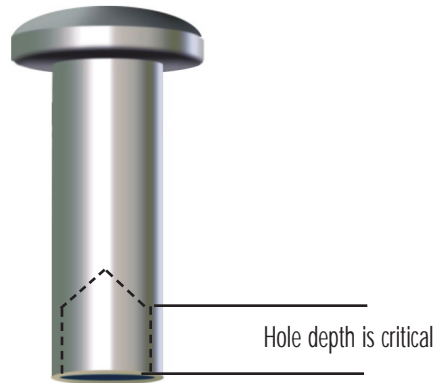
Checking Method

Pin Micrometer

Control Method

B/P tolerance

Hole depth is critical; should never go undersized; check with go-no-go step pin; request from toolroom
ref: Page 22



Cold Shut Too high/Too Low

Potential Problem

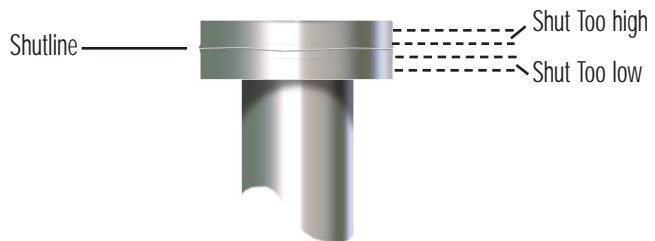
Can cause loose material, potential shorts, and life cycle reduction

Checking Method

Visual and Eye Loop

Control Method

Specify location and "No peeling permissible"



Not flat under head Convex

Potential Problem

Can cause air gaps

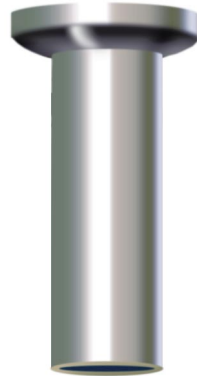
Checking Method

Score with a 6" Scale

Control Method

Specify flatness T.I.R.

Must be flat within .001; check by cross section and optical comparator
ref: Page 23



Not flat under head Concave

Potential Problem

Can cause air gaps/resistance

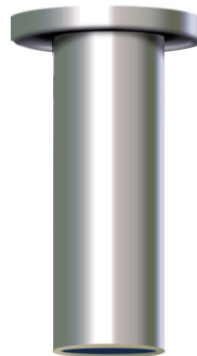
Checking Method

Score with a 6" Scale and Cross Sectional mount

Control Method

Specify flatness T.I.R.

Must be flat within .001; check by cross section and optical comparator
ref: Page 23



Rivet Contact - Process Variation Descriptions

Excessively High Up marks

Potential Problem

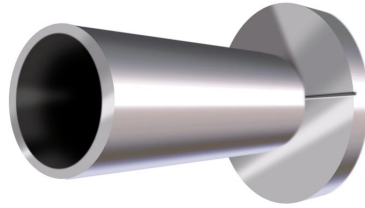
Can cause air gaps

Checking Method

Visual and Eyeloop

Control Method

Specify maximum height



Must e avoided if possible; OK if not measurable at 20X and barely visible

ref: Page 23

Face Not Flat

Potential Problem

May cause engagement irregularity

Checking Method

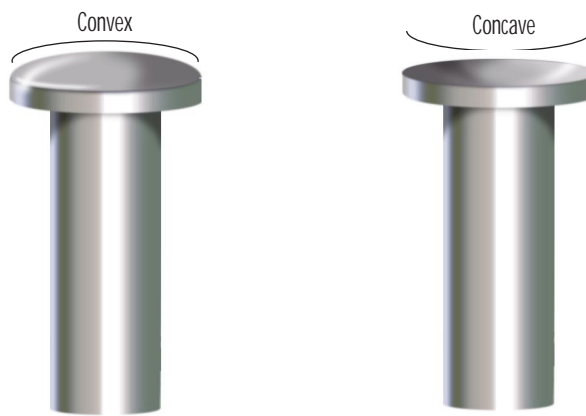
Mic-Block and Drop Indicator

Control Method

Specify flatness T.I.R.

Perform score test with 6" scale for "quick" check; to determine severity use mic. block and indicator

ref: Page 21



Excessive Depth

Tool Bit Rings Underhead

Potential Problem

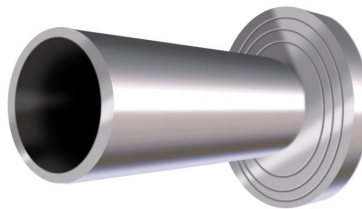
Can cause air gaps

Checking Method

Visual and Eyeloop

Control Method

Specify "Light Tool Bit Rings Only"



Light tool bit rings are OK; balance of surface should be free of nicks and wear marks

ref: Page 23

Edge Cracking

Potential Problem

May cause life cycle reduction and switch failure

Checking Method

Microscope or Optical Comparator

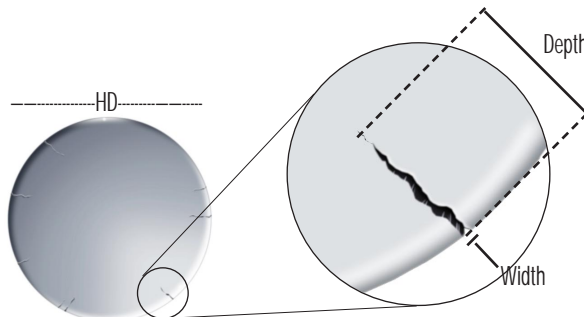
Control Method

Specify maximum length and width of crack

Width: not to exceed .1 x H.D.

Depth: not to exceed .05 x H.D.

ref: Page 27



Some metal alloys may "crack" when headed. Specifications may set limits on "W" (width) and "D" (depth) lengths as compared to the "HD" (head diameter) of the contact

Chamfer Angles

Potential Problem

May cause staking assembly problems

Checking Method

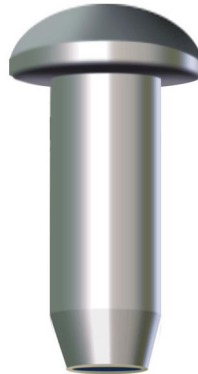
Optical Comparator

Control Method

Specify chamfer angle and tolerance on B/P

If no angle tolerance is given, check length and diameter only

ref: Page 22



Flats on Face Squirt Jobs

Potential Problem

Cosmetic; contact wear

Checking Method

Optical Comparator

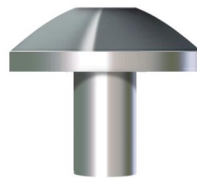
Control Method

Specify maximum flat

Wire diameter is larger than shank diameter;

caution: shank length subject to sudden change; close observation required

ref: Page 21



Flats on Face Small Radius Face

Potential Problem

Cosmetic; contact wear

Checking Method

Optical Comparator

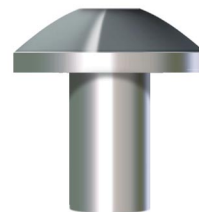
Control Method

Specify maximum flat

Should be no more than 1/3 of the head diameter;

check on optical comparator

ref: Page 21



Rivet Contact - Process Variation Descriptions

Head Diameter Out-of-Round

Potential Problem

Cosmetic; may cause feeding problems/staking

Checking Method

Optical Comparator

Control Method

Specify maximum out of round

Head diameter must be round within 1/2 of the total diameter tolerance



Roll Over Burr

Potential Problem

May cause air gaps and affect switch performance

Checking Method

Visual and Micrometer

Control Method

Specify maximum burr

Must not exceed .001

ref: Page 23



Irregularities and Surface Roughness

Potential Problem

Cosmetic

Checking Method

Visual, Eye Loop, or Surface Finish Tester

Control Method

Specify surface finish or control roughness location

ref: Page 21














Reject
Inside a Circle
1/2 the diameter of the head



Accept
Outside a Circle
1/2 the diameter of the head

Tungsten Disc - Process Variation Descriptions

<u>Pits</u>		<p>These are subjective visuals and need to be evaluated by the Inspector</p>
<u>Edge Cracks</u>		
<u>Light Surface Cracks</u>		

<u>Dull/Discolored</u>			<p>These are visual defects that are unacceptable</p>
<u>Miscuts</u>			
<u>Wavy</u>			

Tungsten Disc - Process Variation Descriptions

Rings in Face



These are visual defects that are unacceptable

Deep Scratches



Chipped Edge



Burr



Wedged

Beyond thickness tolerance



Ventilated Tungsten Disc - Process Variation Descriptions

Off centers

Specify centering



These are subjective visuals and need to be evaluated by the Inspector

Pits



Burr in hole



Punch out
Trapped in Hole



These are visual defects that are unacceptable

Broken Punch



Damaged



Peripheral Voids

Potential Problems

Inconsistent operating characteristics

Checking Method

Visual and Optical Comparator

Control Method

Specify maximum % peripheral voids

*Cannot exceed 25% of the head diameter;
causes decrease in the life of the contact*

ref: Page 18



Off Centers

Potential Problems

Feeding engagement irregularities

Checking Method

Spindle Fixture and Optical Comparator

Control Method

Specify maximum T.I.R.

*Cannot exceed .010 T.I.R.;
causes contact mis-alignment*

ref: Page 18



Tilts

Potential Problems

Can cause feeding problems and contact misalignment;
engagement irregularities

Checking Method

Optical Comparator

Control Method

Control using H.T. Tolerance

*Cannot exceed head thickness tolerance;
causes decreased contact life and contact gap variation*

ref: Page 18



Brazed Composite - Process Variation Descriptions

Center Voids

Potential Problems

Irregular operating characteristics

Checking Method

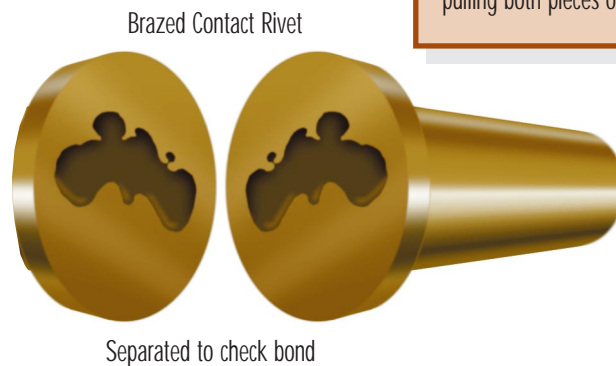
Cross sectional mount, shear test and visual

Control Method

Specify % unbonded area allowance and/or shear test value

*Un-bonded area cannot exceed 25%;
causes decreased contact life and separation of bond*

ref: Page 18



The bonds of bi-metal rivets (brazed) can be visually checked by shearing or pulling both pieces on head apart

Braze Runover

Potential Problems

Premature failure

Checking Method

Visual and Eye Loop

Control Method

Specify runover on face NOT permissible

*Cannot appear on back of head or face;
can cause contacts to weld shut*

ref: Page 18



Contamination

Potential Problems

Can cause premature failure

Checking Method

Visual and Eye Loop

Control Method

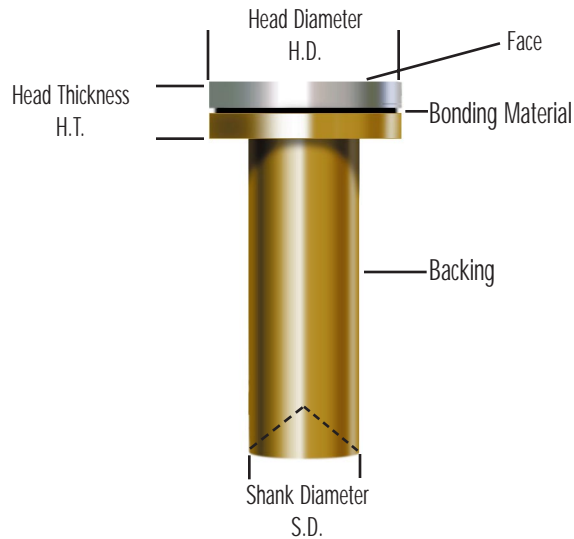
Specify "free of contaminants"

*Face must be free of contamination and discoloration;
can cause contact to fail continuity*

ref: Page 18



Brazed Composite Standards



Face

1. Face must be concentric to shank within .010 T.I.R.
2. Face tilts must not cause head thickness tolerance to be exceeded
3. Minimum bond area to be 75% of head diameter
4. Peripheral opens not to exceed 25% of head diameter
5. Unless otherwise specified on drawing, bond integrity of Tungsten brazed parts. To be shear tested to values as follows:

An initial shear test will be made of 1st parts run thru furnace (10 pieces) thereafter a shear test will be made of 10 pieces for each pan of parts processed. Notify supervisor if shear falls below the following:

Diameter	Min. Shear (lbs)
.125	255
.141	327
.150	370
.156	400
.166	453
.175	503
.200	657
.218	780
.236	915
.250	1026
.312	1598
.375	2309

Note: Use side cutters and peel test if parts cannot be shear tested and examine face and backing. There must be braze alloy on both pieces.

6. Braze runover must not appear on face or back of head.
7. Face must be free of furnace contamination
8. Face and backing must be free of blisters, peeling and discoloration.

Note: All components prior to brazing must be free of contamination.

Coined Button - Process Variation Descriptions

Flash

Potential Problem

Can cause feeding problems

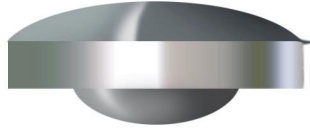
Checking Method

Optical Comparator

Control Method

Specify maximum flash

*OK if you can flick off with your fingernail;
reject if flash exceeds .001; can cause feeding problems*



Washout

Lower Punch Worn Out

Potential Problem

Welding problems

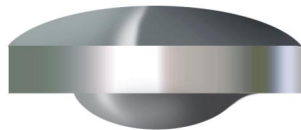
Checking Method

Optical Comparator

Control Method

Specify maximum void

*Lower punch worn out;
reject if inside corner exceeds .005R; can cause weld problems*



Washout

Upper Punch Worn Out

Potential Problems

Can cause decrease of life of contact;
irregular operating characteristics

Checking Method

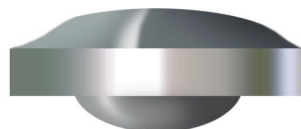
Optical Comparator

Control Method

Specify maximum void

*Upper punch worn out; reject if voids exceed 5% of the head
diameter; can decrease contact life*

ref: Page 21



Projection Face Off Center

Potential Problem

May cause weld flashing

Checking Method

Optical Comparator

Control Method

Specify maximum T.I.R.

Reject if concentricity exceeds .004 T.I.R.; can cause weld splatter



Projection Void

Potential Problems

May cause loss of weld strength

Checking Method

Optical Comparator

Control Method

Specify maximum void or control by B/P tolerances

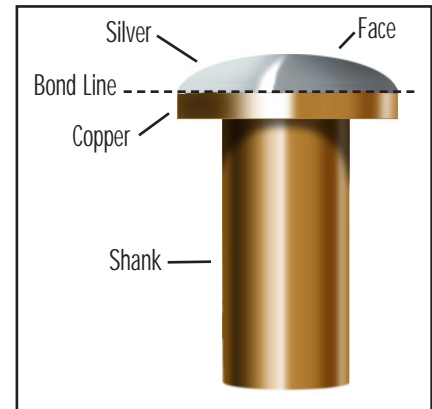
*Reject if projection voids or flats cause projection height to be undersize;
can cause weld problems*



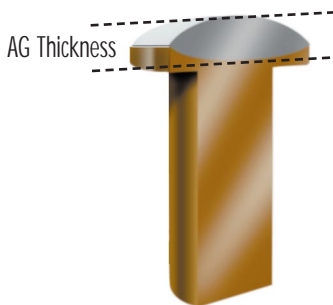
Cold Heading Standards

Face

1. Face radius concentric to shank axis within .008 T.I.R.
2. Face radius tolerance shown on radius tolerance chart.
3. Unless otherwise specified radius must be within tolerance for 75% of its head diameter.
4. Face finish should be smooth and not exceed 8RA finish.
5. Pits, rings, washed out hammers etc. that appear inside a circle equal to 1/2 the head diameter not permissible.
6. Slight cut off marks in center of face o.k. on silver alloys containing nickel or oxide.
7. Cracks, sunbursts, peels, folds, delaminations, flakes, inclusions and blisters not permissible on face.
8. Discoloration of face from burnishing or other sources of contaminates such as copper not permissible.
9. Flat face contacts should be flat within .001 T.I.R.
10. Flat face contacts should be perpendicular to shank and parallel to back of head within .002 T.I.R.
11. Hammer marks must not exceed 5% of H.D.
12. Flashes, burrs and pullups that exceed .001 in length or width not permissible unless they can be flicked off with fingernail and would be removed by the normal burnishing operation.
13. Face corner must be sharp to a void no greater than 5% of the head diameter.



AG Thickness



14. Minimum silver thickness shall be maintained over 75% of the head diameter, but in no case shall the copper extend to the face.
*Exception: contacts less than .120 H.D. minimum silver thickness shall be maintained within .015 of the edge.
15. For radius face contacts to determine min. silver thickness at edge subtract the crown height from the minimum Ag thickness and divide by two. $\left\{ \frac{\text{min. Ag} - \text{C.H.}}{2} = \text{Ag edge min.} \right\}$
16. To check silver thickness cross section part at the centerline, polish with a fine emery cloth and measure with a 40x measuring microscope.

Bond Before Heat Treat

17. Place sample in vise and squeeze to the shank diameter. Break silver away from copper and examine cu surface. A good bond will show a dull Ag appearance. A poor bond will show a shiny starburst effect.

Bond After Heat Treat

18. Place sample in vise and squeeze to the shank diameter, if any parts become totally un-bonded reject the lot.

Cold Heading Standards

Head Sidewall

19. Must be straight within .001.
20. Must be square to face within .003
21. Must be parallel to shank within .003.
22. Must be concentric to shank axis within .005.

Bottom Corner

23. Must be sharp to a radius no greater than 5% of the head diameter.

Countersink

24. Must be a true angle for 75% of its length and must be concentric to the shank axis within .002.

Shank Inside Corner

25. Must not exceed .005 radius or fillet.
26. Must not be irregular, such as a break in the die.
27. Radial corner type must blend between back of head and shank within .003 tangency.

Shank Sidewall

28. Must be straight over 75% of its length.
29. Must be square to back of head within 1 degree and parallel to shank within 2 degrees.
30. Must be round within 1/2 the total diameter tolerance.
31. Tapered sidewalls must be true over 75% of its length.

Shank Outside Corner

32. Must be sharp to 10% x shank diameter in both directions (vertical/horizontal).
33. Maximum burr not to exceed .0015 in length and width.
34. Chamfer type must be to specified angle within + or - 5 degrees.

Shank End

35. Must be parallel to back of head within shank length tolerance.
36. Radial type must be true radius over the center of the shank diameter.
37. Must be square to shank within .004 T.I.R.

Tubular Shank End

38. End of shank may vary in length and be uneven, but must be within print tolerance at all points.

Tubular Hole

39. Hole must be concentric to shank within .003 T.I.R.
40. Depth and diameter tolerance to be + or - .005.
41. Tapered hole angle must be maintained with + or - 2 degrees.

Cold Heading Standards

Tubular Hole Point

- 42. Must be a true angle.
 - 43. Maximum radius of point to be 25% x depth of angle.
-

Back of Head

- 44. Must be flat to .001 max. concave/convex.
 - 45. Shears not permissible.
 - 46. Slight rings or tool marks permissible.
 - 47. Delaminations or loose material not permissible.
-

General

Indents, I.D. marks and undercuts are reference only and do not have to be checked dimensionally
When cavity is in the die the T.I.R. of the shank to the head does not have to be checked.
Collapsing cone jobs have to be checked more thoroughly.
Screen parts thoroughly at machine each hour to remove junk.

Blade Assembly/Staking - Process Variation Descriptions

Daylight

Potential Problem

Can cause "hot spots" and loose contacts

Checking Method

Hold it up to light or Optical Comparator

Control Method

Specify maximum daylight



Distortion

Potential Problem

Can cause "hot spots" and loose contacts

Checking Method

Hold it up to light or Optical Comparator

Control Method

Specify maximum daylight



Reversed

Potential Problem

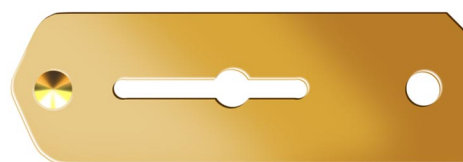
Functional failure

Checking Method

Check to verify correct orientation

Control Method

Visual



This corner provides orientation

Weld Splatter

Potential Problem

Electrical shorts

Checking Method

Visual

Control Method

Specify - "No loose weld splatter"



Blade Distortion

Potential Problem

Can cause "hot spots" and loose contacts

Checking Method

Visual and Optical Comparator

Control Method

Specify maximum distortion



Poor Weld

Potential Problem

Contact can become un-bonded

Checking Method

Pull apart with side cutters and visual

Control Method

Specify, should pull blade material



General Notes

unless otherwise specified

1. Tolerance on fractional dimensions + or - 1/64th.
2. Tolerances on three place decimals + or - .005.
3. Tolerances on angles + or - 2 degrees.
4. Tolerances on flatness .005 T.I.R. per inch.
5. Tolerances on concentricity of brazed parts .010 T.I.R.
6. Tolerances on concentricity of solid/comp. .005 T.I.R.
7. Burrs on punch press stampings must not exceed 10% of stock thickness.
8. Flat disc material for brazing can be from 4# hard to 10# hard.
9. Annealed material for brazing can range from 69 or below on the rockwell 15t scale.
10. When print shows a straight sidewall it is interpreted as straight for 1/2 of head thickness.

Operators/Inspectors

1. Always match material tag against print before checking parts to insure correct material is being used.
2. Determine order quantity and next operation (aids in judgement calls).
3. Study quality history file for previous rejections or complaints.
4. Study print for part configuration, I.D. marks, indents, undercuts, cavity die/head in hammer, special notes, etc. to determine completeness of part.
5. Visually check for flashes, peels, shears, hammer marks, voids, tails, rings, face finish, dig ins, shank marks, fillets, etc.

****All of the above should be done before dimensional checks are made.**

6. Cracked pin across weld projection of coined part is OK if not measurable on optical comparator.
7. If Ag Cdo pre-ox part is annealed it normally will be double headed consequently the finish on the shank end will be more critical.
8. Noble metals such as gold, platinum, palladium and their alloys are very costly and should be handled as such.
9. Ag Cdo, Ag C, Ag Ni, Ag Fe, etc. materials are brittle and prone to cracking. They are used in switches for automotive and appliance controls.
10. Fine silver has the highest electrical and thermal conductivity. This material resists oxidation.
11. Ag Cu, Ag Cd, Ag Pd, etc. is used in high inrush applications such as motor starters. Contamination not as critical.
12. Tungsten is highly resistive to wear and welding closed. It is used in horn relays and business machines. It is brittle and has a tendency to crack.
13. Usually the smaller the part is the lower the current application, consequently the part must be free of contamination and have a good face finish.
14. Steel base metals, (especially those with holes) should have a light oil film on them prior to plating. This will prevent rust and pitting.

Helpful Hints

15. Copper and machine composite parts, (especially those with holes) must be thoroughly cleaned and dried prior to packaging to prevent discoloration and oxidation. Appearance, (bright and shiny) is important to most customers.
16. Copper on silver faces is unacceptable.
17. Loose discs and backings mixed in with finished parts is unacceptable. They jam feeding systems and give customers the impression that they are becoming unbonded.
18. Burnisher must observe tumblers to determine if loose parts are stuck to the sides of tumbler. Notify Q.A.
19. Scaler must observe parts to detect loose, damaged, foreign, or incomplete parts during scaling operation. Notify Q.A.
20. Burnishing operator must not exceed prescribed cycle time. Over tumbling will roll up edges and damage faces.
21. Tumbling media must not contain any sources of silica. This substance is highly resistive and can cause switch failure.
22. Do not handle phos-bronze blades or tungsten discs with bare hands. Use nitrile or white gloves, otherwise fingerprints will appear on parts.
23. Use extreme caution when consolidating and handling parts to prevent accidental spillage. Even small quantities of foreign parts mixed in with good parts and create major problems with customers feeding systems. They jam systems and cause excessive downtime.