NOTES:
1. THIS DOCUMENT CONTROLS INSTALLATION OF INFOCHIP DURAPLUG 9.5 UHF RFID TAG PRODUCTS IN THE FOLLOWING PRESS-FIT INSTALLATION TYPES: "NEAR-FLUSH" AND "RECESSED". ADHESIVE INSTALLATIONS ARE DETAILED AT THE END OF THIS DRAWING.
2. DURAPLUG 9.5 UHF MUST BE INSTALLED INTO METALLIC ASSETS. FOR MAXIMUM READ RANGE, ESPECIALLY WHEN TAGGING SMALLER ASSETS, THE DP9.5 POSITION AND ORIENTATION ON THE ASSET SHOULD BE AS SPECIFIED BELOW ON THIS SHEET.
3. IT IS THE CUSTOMER RESPONSIBILITY TO ENSURE THAT THE INSTALLED LOCATION OF THE DURAPLUG DEVICE ON THE ASSET WILL PERMIT THE TAG TO BE SCANNED BY ANY RFID READERS DESIRED FOR USE BY THE CUSTOMER.
4. IT IS THE CUSTOMER RESPONSIBILITY TO ENSURE THAT THE TARGET ASSET Maintains STRUCTURAL INTEGRITY AFTEr DRILLING AND INSTALLATION OF THE DURAPLUG 9.5 UHF DEVICE. ASSETS SHOWN IN THIS DRAWING ARE ARBITRARY AND ARE SHOWN FOR EXAMPLE REFERENCE ONLY. ANY ASSET TOP SURFACES ARE SHOWN FOR VISUAL CLARITY BUT INSTALLATIONS TO CURVED SURFACES SUCH AS PIPE OD ARE NOT ACCEPTABLE.
5. INFOCHIP RECOMMENDS THE USE OF CUSTOM INFOCHIP-SUPPLIED DRILL BITS TO ENSURE THE DRILLED HOLES EXHIBIT THE CRITICAL FEATURES AND ACCURACY NEEDED FOR A RELIABLE PRESS-FITTED INSTALLATION. BITS FOR DURAPLUG 9.5 UHF ARE CURRENTLY OFFERED IN 2 VERSIONS BASED ON THE INSTALLATION TYPE. DRILL BIT PART NUMBERS ARE CLEARLY MARKED ON EACH BIT.
6. INFOCHIP RECOMMENDS THE USE OF A CUSTOM INFOCHIP-SUPPLIED TOOL (HOLETOOL-9.5) FOR ANY INSTALLATIONS TO BE USED IN SEVERE ENVIRONMENTS WHICH MIGHT NEED INCREASED PRESS-FIT RETENTION. THE HOLETOOL-9.5 IS A BASIC HAND-OPERATED TOOL USED TO ADD AN UNDERCUT TO THE DRILLED HOLE BEFORE PRESS-FITTING.
7. INFOCHIP RECOMMENDS THE USE OF MILLING MACHINES WITH A COLLET-TYPE CHUCK TO ENSURE HIGH RIGIDITY WITH MINIMAL RUNOUT. A "DRILL-CHUCK" SHOULD NOT BE USED. A COLLET CHUCK TO BE USED SHOULD BE VERIFIED BY DIAL INDICATOR WITH A TOTAL INCLUDED RUNOUT OF LESS THAN 0.013MM (0.0005"). HAND DRILLS CANNOT BE USED. UNLESS PRE-AUTHORIZED BY INFOCHIP, ANY DRILLING AND INSTALLATION METHODS OTHER THAN THOSE SPECIFIED ON THIS DRAWING WILL VOID ANY WARRANTIES.
8. INFOCHIP REMINDS THE CUSTOMER THAT THE DURAPLUG 9.5 UHF SHOULD FOLLOW EFFECTIVE MACHINING PRACTICES (SPINDLE SPEED, COOLANT, Etc.) FOR THE SPECIFIC ASSET METAL AND HARDNESS TO ENSURE MAXIMUM LIFE OF THE DRILLING TOOLS AND ACCURACY OF THE DRILLED HOLE.
9. PRESS-FITTING OF THE DURAPLUG 9.5 UHF SHOULD BE CARRIED OUT AS DETAILED ON THE DRAWING TO ENSURE IT IS NOT DAMAGED DURING THE INSERTION.
10. THIS DRAWING IS TO BE PRINTED IN FULL COLOR AS SOME VIEWS ARE COLORED FOR VISUAL CLARITY. ASSET SURFACES SHOWN IN GREY COLOR ARE FORMED BY THE DRILLING PROCESS.
11. INSTALLATION PROCEDURE FOR "NEAR-FLUSH" INSTALL IS SHOWN ON SHEET 2. INSTALLATION PROCEDURE FOR "RECESSED" INSTALL IS SIMILAR AND IS NOT SHOWN ON THIS DRAWING.

DETAILING TAG POSITION AND ORIENTATION

EXPLANATION OF MOUNTING TAG WITH PREFERRED ORIENTATION (POLARIZATION) APPLICABLE FOR SMALL OR SLANTER ITEMS INCLUDING TUBULAR ITEMS

BEST RANGE
PRECONDITIONS FOR MAXIMUM READ RANGE
DASHED LINE IS AS LONG AS POSSIBLE, ALIGNED WITH LONG DIMENSION OF PART VENT NOTCH FACES 0 DEG AWAY FROM DASHED LINE

OK (READ RANGE WILL BE CLOSE TO BEST)
DASHED LINE IS AS LONG AS POSSIBLE, ALIGNED WITH LONG DIMENSION OF PART VENT NOTCH FACES 180 DEG AWAY FROM DASHED LINE

REDUCED (READ RANGE WILL BE REDUCED)
AVOID THIS IF POSSIBLE
DASHED LINE IS AS LONG AS POSSIBLE, ALIGNED WITH LONG DIMENSION OF PART VENT NOTCH FACES 90 DEG AWAY FROM DASHED LINE

AVOID THIS IF POSSIBLE
DASHED LINE IS AS LONG AS POSSIBLE, ALIGNED WITH LONG DIMENSION OF PART VENT NOTCH FACES 45 DEG AWAY FROM DASHED LINE

OK (READ RANGE WILL BE CLOSE TO BEST)
DASHED LINE IS AS LONG AS POSSIBLE, ALIGNED WITH LONG DIMENSION OF PART VENT NOTCH FACES 0 DEG AWAY FROM DASHED LINE

"NEAR-FLUSH" INSTALL EXAMPLE

"RECESSED" INSTALL EXAMPLE
NOTES:

1. A MODEL OF THE FLUSH DRILL BIT IS SHOWN ON THE LEFT OF THIS PAGE FOR REFERENCE (DRILL FLUTES ARE NOT SHOWN).
2. THE BIT IS DESIGNED TO BE USED IN A PLUNGE OPERATION (AS A DRILL BIT) IN A MILLING MACHINE.
3. THE BIT IS A 2-FLUTE HELICAL TYPE CUTTER, GROUND TO INFOCHIP SPECIFICATION FROM SOLID MICRO-GRAIN CARBIDE. BITS ARE COATED WITH TITANIUM NITRIDE.
4. BITS ARE TO HAVE PERMANENT MARKINGS AS SHOWN IN THE DRAWING VIEW ON THIS SHEET, INCLUDING THE DESIGN REVISION AS SHOWN.
5. BITS ARE TO BE INDIVIDUALLY PACKAGED AND CUTTING END SHOULD BE PROTECTED.

6. THE DEPTH OF THE "SPOT-FACE" FEATURE IS TO BE DETERMINED BY THE CUSTOMER. IT IS CONTROLLED BY ADJUSTING THE DRILLING DEPTH. INFOCHIP RECOMMENDS TO USE A MINIMAL DEPTH EFFECTIVE HOLE DEPTH TOLERANCE IS ENSURED BY THE USE OF INFOCHIP "NEAR-FLUSH" BIT PROVIDED THAT THE DRILLING DEPTH IS SUFFICIENT TO PRODUCE A VISIBLE "SPOT-FACE" FEATURE.

7. EFFECTIVE HOLE DEPTH TOLERANCE IS DETERMINED BY THE USE OF INFOCHIP "NEAR-FLUSH" BIT PROVIDED THAT THE DRILLING DEPTH IS SUFFICIENT TO PRODUCE A VISIBLE "SPOT-FACE" FEATURE.

8. THE "NEAR-FLUSH" BITS ARE TYPICALLY USED FOR INSTALLATION ON FLAT ASSET SURFACES. IT IS ALSO ACCEPTABLE FOR INSTALLATION TO ASSETS WITH CONVEX CURVATURE WHERE THE RADIUS OF CURVATURE IS A MINIMUM OF APPROXIMATELY 0.75 INCHES. AS AN EXAMPLE, THE NEAR-FLUSH BIT CAN BE USED FOR INSTALLATION ON A PIPE MEASURING 2 INCHES IN OUTER DIAMETER.

9. INFOCHIP RECOMMENDS THAT THE CRITICAL PRIMARY BORE (LOWER) BE MEASURED AFTER DRILLING TO ENSURE A PROPER PRESS-FIT. SUGGESTED MEASURED BORES ARE SHOWN IN DETAIL B ON THIS SHEET. THE LOWER BORE DIAMETER CAN BE MEASURED USING A HAT BORE TYPE HOLE GAUGE ALONG WITH A MICROMETER.
NOTES:

1. A MODEL OF THE RECESSED DRILL BIT IS SHOWN ON THE LEFT OF THIS PAGE FOR REFERENCE (DRILL FLUTES ARE NOT SHOWN).
2. THE RECESSED BIT IS DESIGNED TO CREATE A VARIABLE-DEPTH COUNTERSUNK RECESS IN A PLUNGE OPERATION (DRILLING).
3. BITS ARE 2-FLUTE HELICAL TYPE, GROUND TO INFOCHIP SPECIFICATION FROM SOLID MICRO-GRAIN CARBIDE. BITS ARE COATED WITH TITANIUM NITRIDE.
4. BITS ARE TO HAVE PERMANENT MARKINGS AS SHOWN IN THE DRAWING VIEW ON THE SHEET INCLUDING THE DESIGN REVISION AS SHOWN.
5. BITS ARE TO BE INDIVIDUALLY PACKAGED AND CUTTING END SHOULD BE PROTECTED.
6. THIS DRAWING INCLUDES VIEWS OF A REFERENCE ASSET, DRILLED TO AN ARBITRARY RECESS DEPTH SHOWN FOR EXAMPLE. THE BIT SHOULD BE ABLE TO ACCOMMODATE A MAXIMUM RECESS DEPTH AS SHOWN ABOVE (MAXIMUM THEORETICAL RECESS). NOTE THAT READING RANGE IS TYPICALLY REDUCED AS THE RECESS DEPTH IS INCREASED SO READING RANGE SHOULD BE TESTED AT THE TARGET RECESS DEPTH.
7. ALL FEATURES ON THE CUTTING END OF THE BIT ARE CUTTING FEATURES INCLUDING RADII. THERE ARE NO NON-CUTTING FEATURES.
8. INFOCHIP RECOMMENDS THAT THE CRITICAL PRIMARY BORE DIAMETER BE MEASURED AFTER DRILLING TO ENSURE A PROPER PRESS-FIT. SUGGESTED MAXIMUM ALLOWABLE MEASURED BORES ARE SHOWN IN DETAIL E ON THIS SHEET. THE LOWER BORE DIAMETER CAN BE MEASURED USING A HALF-BALL TYPE HOLE GAUGE ALONG WITH A MICROMETER.

REFERENCE RECESSED ASSET
(GREY SURFACES ARE CREATED BY DRILLING)
PROCEDURE FOR USING SEVERE SERVICE HOLE TREATMENT TOOL FOR DURAPlug 9.5 UHF (APPLICABLE WITH PRESS-FIT INSTALLS ONLY):

1. Check that the lower bore is within specification before proceeding.
2. Remove any debris from the drilled hole.
3. Locate the HoleTool-9.5 over the hole and ensure the tap is engaged in the hole.
4. Hold the base firmly against the asset with one hand to prevent the tool from tilting or moving during use.
5. Grasp the flats near the bottom of the base between thumb and index finger.
6. Apply roughly 3 pounds of downward force to the knob and turn the knob clockwise by hand.
7. Continue pressing down while turning the tap, the tap contacts the bottom of the hole. At this point, a sharp rise in driving torque will be felt and tapping should be stopped at this point. (About 2.5 turns).
8. Hold the base firmly and turn the knob counterclockwise to extract the tap. Once the tap is disengaged with the threads (about 2.5 turns), the tool can be lifted away and hole treatment is completed.

ADDITIONAL NOTES:

- The HoleTool-9.5 is used to create a controlled undercut in the lower bore of drilled holes for Duraplug 9.5 UHF. Press-fitting into the treated (undercut) holes permits maximum press-out force and maximum retention of the installed Duraplug.
- The resulting controlled undercut is a thread-form with partial depth and it is visible to the naked eye. An example photograph of side-by-side treated and untreated drilled holes is shown below.
- The HoleTool-9.5 can be used to treat for both "flush" and "recessed" holes.
- The HoleTool-9.5 is designed to be used by hand where holes are drilled into assets on flat surfaces. The tool base can be modified by machining or redesign so that it will work with other asset surfaces (such as cylindrical surfaces).

PHOTOGRAPHIC EXAMPLE OF TREATED AND UNTREATED HOLES

Visible Helical Form

No Visible Form

TREATED HOLE

UNTREATED HOLE
**INSTALLATION STEPS (NEAR-FLUSH, PRESS-FIT TYPE):**

**STEP 1:** Ensure asset is drilled and that the hole is treated with severe service hole tool, as applicable, to specifications and ensure the install hole is cleaned of any cutting fluid and debris.

**STEP 2:** If required, coat the sidewalls and bottom of the drilled hole with a "Wet" corrosion inhibitor product. (Step is not shown.) Corrosion inhibitor products are not specified on this drawing.

**STEP 3:** If using a corrosion inhibitor product, ensure that it is fully wet before processing. Place the head up with logo side up onto the asset near the hole. For maximum reading range, orient the Duraplug as specified on sheet.

**STEP 4:** Use a press such as an arbor press or drill press and choose the driver tool in the press. (Step is not shown.)

**STEP 5:** Visually align the asset and nested Duraplug with the driver tool.

**STEP 6:** Use a press such as an arbor press or drill press and chuck the driver tool in the press. (Step not shown.)

**STEP 7:** Complete the installation by tapping the tool with a 1 lb to 1.5 lb dead-blow hammer to fully seat the Duraplug.

**ADDITIONAL NOTES:**

- **Example of a Driver Tool** is shown with suggested dimensions. Ensure that the driving face of the tool is flat, smooth, and square. The tool can be turned on a lathe using 7/16” or 1/2” hexagonal or round bar stock.

- **Acetal Material (Delrin, Acetron, etc.)** is recommended for the material.

- **If the installation will not be using a treated hole**, the Duraplug may be installed manually if a press is not practical. In this case, it is recommended to use the driver tool and align it by eye to the nested Duraplug, keeping it parallel to the drilled hole. Complete the installation by tapping the tool with a 1 to 1.5 lb dead-blow hammer to fully seat the Duraplug.

- **For treated holes**, InfoChip strongly recommends using a press for the installation.

- **Extraction:** An installed Duraplug can be removed without damaging the installation hole. The following procedures can be used with flush and recessed installations using treated and untreated holes:
  1. Drill through the center of the plastic logo surface of the tag using a 1.4 mm diameter drill bit at high speed 1.25 times the recommended depth to avoid damage to the cutter.
  2. Use a 1/4” (6.35 mm) diamond on an arbor press to break the Duraplug. Gently break up the ceramic core. Abruptly clear any loose particles using a vacuum or compressed air. Ensure to wear protective eyewear and clothing.
  3. For a treated hole, simply twist the tool counter-clockwise and the plug will shear out.
  4. For an untreated hole, twist and rotate slightly and the plug will move out of the hole.

**DURAPLUG** should be flush to slightly depressed relative to spot-face feature after install.

**DURAPLUG SHOULD BE FULLY INSERTED TO BOTTOM OF HOLE FOR FUTURE READING FUNCTION.**

**Reference Installation Assemblies:**

DuraPlug 9.5 UHF

**Section F-F**

**Duraplug should be fully inserted to bottom of hole for future reading function.**

**Detail Installed Scale 1:1**

**DETAILING "NEAR-FLUSH" INSTALLATION PROCEDURE PRESS-FIT TYPE**

**INSERTED**
INSTALLATION STEPS (NEAR-FLUSH, ADHESIVE TYPE):

1. Ensure asset is drilled using InfoChip Drill Bit-9.5-HAND-DRILL to InfoChip Specification: Asset-Ref-DP9.5-Adhesive. If intending to cover the tag with adhesive, ensure to use a "shoulder recess" height approximately as shown on Asset-Ref-DP9.5-Adhesive.

2. If required, clean the installation hole area so that it is free of any debris or cutting fluids.

3. Dispense adhesive to the floor of the drilled hole until it is roughly 50% to 75% filled. Minimize bubbles while dispensing.

4. Ensure vent-notch is aligned to asset with preferred orientation from Sheet 1 and place DP9.5 into the wet adhesive. Ensure logo side faces up and use a soft tool to press the DP9.5 down fully to the bottom of the hole. If using self-leveling adhesive, it should flow above and cover the DP9.5 tag. If needed, use a tool to ensure the adhesive completely covers the tag's logo surface. If necessary, add more adhesive and break large bubbles if needed.

5. If needed, use a flat thin tool such as a razor blade as a scraper tool to remove excess adhesive and create a flat adhesive surface, flush with asset top surface. If needed, wipe away any excess adhesive after scraping flat.

6. Allow adhesive to cure to adhesive manufacturer's specifications.

7. Carry out basic visual inspection and functional reading test.

TOLERANCES ON LINEAR DIMENSIONS ARE 0.10mm UNLESS OTHERWISE SPECIFIED.