# THE PROCESS OF PRODUCING P-5678 SPRING PINS FOR NORTHLAND TRUCKS

Prepared For
Don Klepp, English 132 Instructor
Okanagan University College

By
Richard Pelletier
Mechanical Engineering Technology 1
Okanagan University College

20 February 2000

# TABLE OF CONTENTS

# INTRODUCTION

The P-5678 spring pin is used on Northland Truck's model 6800 trucks. Eight of the P-5678 pins hold the springs to the shackles on each truck frame. A spring pin takes approximately five minutes to produce, from stock bar to a complete working pin ready for installation.

The spring design uses 1.125 diameter$\pm .001$ C1018 precision ground stock. (The material specifications are chosen by Northland Truck engineers).The spring pin is 6 inches long. A grease hole is drilled 3.75 inches deep down the center, with two 1/8 inch holes drilled on the side 180° from each other. Two locating grooves are milled for positioning the pin on the truck. Figure 1 shows the location of each of the pin's parts.

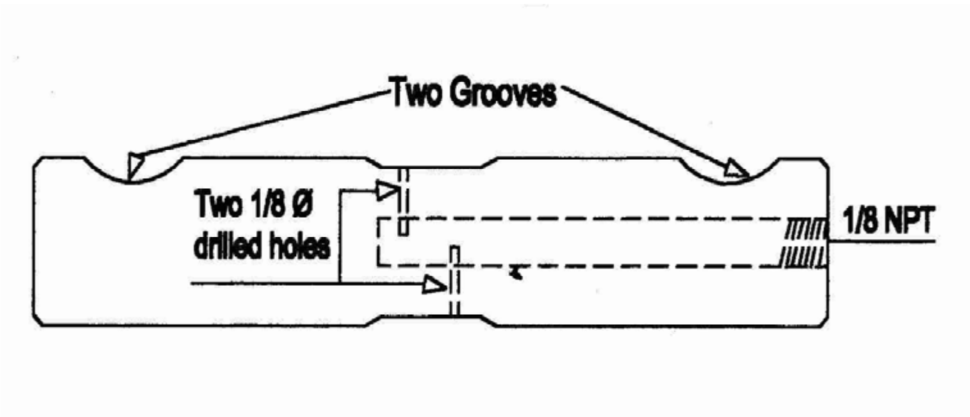


**Figure 1. Front view of the P-5678 spring pin**

Machines involved in the process include a cnc saw, lathe, mill, built in house slotting machine, three upright drill presses, tapping head, and a hardening machine. (The pin is hardened to 55 to 60 rockwell.)

Producing the P-5678 spring pin requires several stages:

- saw cutting
- lathe machining
- slotting and engraving
- milling
- drilling
- tapping
- hardening

## PRODUCING THE P-5678 SPRING PIN

**Note: all measuring tools are calibrated according to ISO 2001 standards. All procedures performed on a part are checked by the person(s) who set up the procedure and double checked by a qualified person(s). Both the machinist (or the saw operator) and the quality control supervisor must sign the process sheet.**

### Saw Cutting

20' precision ground bars are removed from their protective covering and placed carefully, 7 rows wide and 5 bars high (as in Figure 2). The saw is then programmed to cut the desired length and the quantity needed (Usually 3500 blanks per run, twice a month). Part way down the first cut on the first bar, the saw is stopped. That first cut is checked by the operator and then brought to a qualified person for a second inspection. The “work in process” sheet is signed by both operator and inspector to show that this part is ready for production. (The saw can cut 3500 blanks in 8 hr).

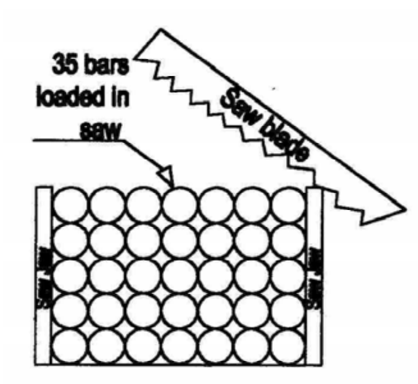


**Figure 2. Saw cutting in progress**

### Lathe Machining

The Haas SL 30 has been selected for the machining process due to its high continuous accuracy, and its 1-second tool to tool quick changer. (See Figure 3.)


**Figure 3. Haas SL-20 lathe (Hass products)**

A software cutting program has been written to control the various cuts on the Haas lathe. This program is down loaded into the lathe from the main p.c. Included in the program is a tooling list that contains the appropriate tools, jaws, and stops to use in the setup. The stop is set to the desired length, jaws are bolted to the chuck, and the turning tool and spot drill are bolted on the turret. The chuck is checked for run out – if more than .003" is showing on the dial indicator, then the jaws must be re-bored.

Kennametal cnmg 432 inserts are selected for the machining. This type of insert works best for feeds and speeds used in the machining to produce the part's surface finish and to prolong insert 's life. A 5/8 high speed steel (h.s.s.) spot drill is used for centering the grease hole, which is later drilled in another operation.

Once all tooling is installed and the chuck jaws run true, a blank is inserted in the chuck (see Figure 4). The tools are then located off the face of the blank, and data is inputted into the lathe. The blank is faced off and a .06" chamfer is produced leaving .05" on the second side for machining. The turret then moves 3" away from the part and stops. The operator next slides the part out to the turret, then re-clamps the jaws. (See Figure 5.) The machine is ready to machine the necking part of the pin. After this machining, the turret then moves out of the way and stops again; the operator then turns the pin around end for end and clamps the chuck. The lathe then faces the pin off to length to produce another .06" chamfer. Next, the 5/8 spot drill makes a center mark for the grease hole

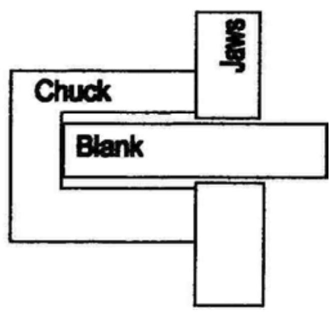


**Figure 4. Blank inserted in chuck**

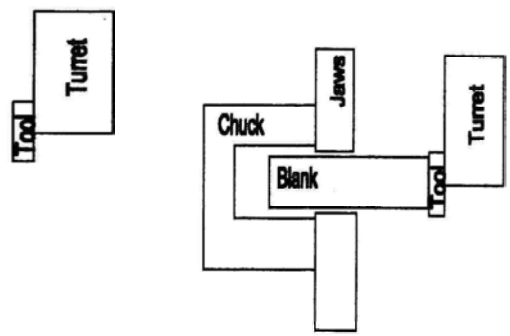


**Figure 5. Blank at second stop**

## Slotting And Engraving

After the pin has been machined, the end with the center mark is placed into a slotting machine. A 1/8" wide x 1/8" deep slot is produced. Then the pin is removed from the slotting machine and the other end of the pin is engraved with an air pencil. (See Figure 6 on the next page). The slotting machine, which has been designed and built in-house, is situated right beside the lathe so the operator can slot and engrave while other pin is being machined. The spring pin is now ready for milling. The lathe work, slotting, and engraving take less than a minute.

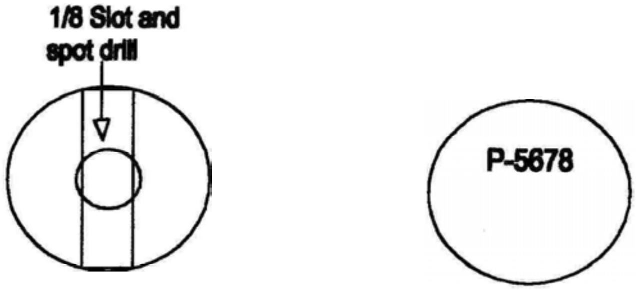


**Figure 6. Spot drill with 1/8" slot and serial number engraved**

## Milling The Pin

Grooving the spring pin requires high r.p.m.s and rigidity. The Leadwell M6 milling machine meets the r.p.m. and rigidity requirements. Like the Haas lathe, the Leadwell M6 is controlled by software down loaded from the main p.c. to the milling machine. A tooling list is produced from the program, which details the specific jaws and tooling used.

A set of milled jaws are bolted on the vice; this set of jaws holds two spring pins at a time. A locating pin in one jaw locates the spring pin slot 90° vertical to the grooves. A Kennametal 9200/.5r carbide form tool is selected for the grooving of the parts (as in Figure 7). The form tool is inserted into a solid holder for rigidity purposes. Fixture and tool are located and coordinates are inputted into the cnc (computer numerically controlled program). The spindle rotates at 7000 r.p.m. and the feed is 2.0 inches per minute. At this speed and feed, each groove can be machined in one pass and maintain accuracy up to 600 to 700 pins before the tool must be re-sharpened. The milling process takes approximately 1 minute to groove two pins. While the machine runs, the operator de-burrs a slight burr which appears on the groove. The pins are ready for drilling and tapping.

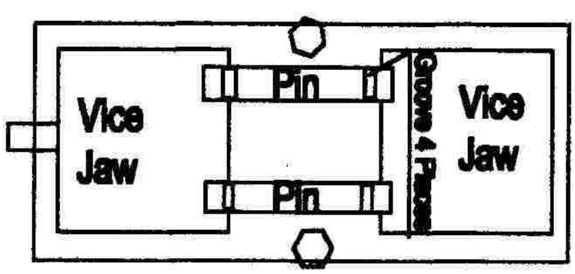


**Figure 7. Two pins set in vice**

## Drilling And Tapping

A Bulldog upright drill press is used to drill the grease hole. The pin is inserted, with its center mark up, into a chuck, which is permanently fastened to the drill press. The press uses a 11/32” diameter high spiral cobalt drill, which removes the swarf out of the hole. A feed of .009 inch per revolution and 800 r.p.m. are used to obtain the longest drill life before sharpening. The drill bit will last up to 125 to 150 pieces before sharpening.

The drill press has an automatic feed that retracts the drill bit out of the hole when the desired depth is obtained. While this hole is being drilled, another Bulldog drill press is being used. A V-block is permanently stationed on the drill press. The spring pin rests in the V- block and the operator drills two 1/8” holes 180° apart, breaking into the 11/32” grease hole. The 1/8 drill bit is an h.s.s. 120° stub drill, whose r.p.m is 1500. The operator feeds the drill in by hand. The pin is placed into a fixture on another Bulldog drill press. A 1/8”, 18 n.p.t h.s.s. tapping head mounted in the spindle of the drill press is used to tap the 1/8” n.p.t hole to a controlled depth.

After all the holes are drilled and tapped, the part is now ready for hardening.

## Hardening The Pin Through Induction

Induction hardening process is a non-contact technique that provides localized heating through custom designed coils, one of which is shown in Figure 8.

**Figure 8. Custom designed coil (Inductotherm)**

Because the heat is transferred to the product through electromagnetic waves, there is no product contamination. This process allows the right amount of heat to be applied exactly where it is needed for an exact period of time, ensuring controlled and accurate performance that can be easily repeated. The pin is inserted through the coil and held between its centers. As the coil travels up the pin, heating it to 1200° F., water is sprayed directly underneath coil to cool the pin. This process takes approximately 30 seconds to complete. The pin is removed and ready to check for hardness. (The pin is cool enough for an operator to handle with his/her bare hands.)

## Testing For Hardness

The degree of hardening is tested with a Rockwell C Scale machine. The depth of the impression left in the part by a 10 mm hardened steel ball is measured and calculated by the machine to determine hardness, which for the spring pin should be 55 to 60 rockwell.

## CONCLUSION

The P-5678 pin has been in production for 10 years, without any change in design. However, many changes have been made in the process of machining the spring pin. The outside diameter used to be machined to 1.125” $\pm .001$; now bar stock is purchased already ground to size. Because a large quantity is purchased monthly, the material can be delivered right from the steel mill, eliminating the middleman.

A machinist sets up all the processes, and an operator performs the production. It is essential that a operator does the engraving, slotting, and de-burring when machines are operating. This eliminates having to do separate processes on their own, and time and money are saved. Creating the slotting machine eliminated a separate process: the operator could now stand at the lathe and slot the pin while the lathe is in operation. Before, this operation was done on a different machine away from the lathe adding approximately 30 seconds per pin.

It is essential to keep improving production, because it saves money, and makes the equipment available for the next job. Cnc equipment and special form cutting tools over the years have cut production costs by 50 percent.

As of April 1, 2000, the P-5678 spring pin will no longer be in production for manufacturing, just for distribution of replacement parts. A new design of the pin will replace the P-5678 design on Northland 6800 trucks and other Northland models.

## SOURCES CITED

"Haas products-CNC Lathe Horizontal Spindle". Champions Machine Tool Sales. Retrieved 6 February 2000. <www.championscnc.com>

Inductotherm. "Companies By Technologies – Heating". Inductotherm Industries. Copyright 2000. Retrieved 6 February 2000. <www.inductothermindustries.com>