SkillsUSA
2010 Contest Projects

Marine Service Technology

Click the “Print this Section” button above to automatically print the specifications for this contest. Make sure your printer is turned on before pressing the button.

Instructions for Skills USA Marine Technologies Test

Description of Test

1. Create a Boat Pre-Delivery Inspection Form

You must create a list of the items, in order of importance, that should be checked before the boat is delivered to the customer. Pre-Delivery forms are used by many dealers to assure that the boat is "customer ready" and all safety features have been checked before the actual delivery takes place.

2. Create a Trailer Pre-Delivery Inspection Form

You must create a list of the items, in order of importance, that should be checked before the boat trailer is delivered to the customer. Pre-Delivery forms are used by many dealers to assure that the trailer is "customer ready" and all safety systems have been checked before the actual delivery takes place.

Pre-Delivery Inspection
Judges Scoring Sheet

Workstation # _____ Contestant #_____

Boat

1. Used boat as example to determine specific items to be checked _____ (25)
2. Included “critical” items like blower operation / fuel leaks _____ (25)
3. Categorize areas if inspection (boat electrical, engine, drive, etc..) _____ (25)
4. Completeness of list _____ (25)

Total _____ (100)

Trailer

1. Used trailer as example to determine specific items to be checked _____ (25)
2. Included “critical” items like tire pressure / brake function / lights _____ (25)
3. Included proper boat to trailer fit / bunk adjustment _____ (25)
4. Completeness of list _____ (25)

Total _____ (100)

Overall Evaluation

1. Used systematic / organized process to determine overall needs _____ (25)

Total Score _____ (225)

Boat PDI List

Work Station # _____ **Contestant #_____**

- ☐ 1 _____
- ☐ 2 _____
- ☐ 3 _____
- ☐ 4 _____
- ☐ 5 _____
- ☐ 6 _____
- ☐ 7 _____
- ☐ 8 _____
- ☐ 9 _____
- ☐ 10 _____
- ☐ 11 _____
- ☐ 12 _____
- ☐ 13 _____
- ☐ 14 _____
- ☐ 15 _____
- ☐ 16 _____
- ☐ 17 _____
- ☐ 18 _____
- ☐ 19 _____
- ☐ 20 _____
- ☐ 21 _____
- ☐ 22 _____
- ☐ 23 _____
- ☐ 24 _____
- ☐ 25 _____

Trailer PDI List

Work Station # _____ **Contestant #_____**

- ☐ 1 _____
- ☐ 2 _____
- ☐ 3 _____
- ☐ 4 _____
- ☐ 5 _____
- ☐ 6 _____
- ☐ 7 _____
- ☐ 8 _____
- ☐ 9 _____
- ☐ 10 _____
- ☐ 11 _____
- ☐ 12 _____
- ☐ 13 _____
- ☐ 14 _____
- ☐ 15 _____
- ☐ 16 _____
- ☐ 17 _____
- ☐ 18 _____
- ☐ 19 _____
- ☐ 20 _____
- ☐ 21 _____
- ☐ 22 _____
- ☐ 23 _____
- ☐ 24 _____
- ☐ 25 _____

Instructions for Skills USA Marine Technologies Test

Description of Test

1. Test Condenser Charge Coil
2. Battery Charge Coil
3. Pulser Coil

You must use the service materials and tools provided to properly measure and record the test information on the Suzuki Outboard electrical ignition components.

You must complete the appropriate section of the worksheet provided as you do the job making notations of the components condition as you proceed.

Skills USA Test Evaluation Form

Work Station #_____ **Technician #_____**

Condenser Charge Coil Tests (14 points each)

1. Setup multi-meter properly for test. _____(14)
2. Examine coil condition-cuts or damage to coil or insulation. _____(14)
3. Performed resistance test and recorded results. _____(14)
4. Used correct specification for determination of results. _____(14)
5. Performed short to ground test properly. _____(14)
6. Reached correct test results _____(14)

Condenser Charge Coil Total _____**(84)**

Battery Charge Coil Tests (14 points each)

1. Setup multi-meter properly for test. _____(14)
2. Examine coil condition-cuts or damage to coil or insulation. _____(14)
3. Performed resistance test and recorded results. _____(14)
4. Used correct specification for determination of results. _____(14)
5. Performed short to ground test properly. _____(14)
6. Reached correct test results. _____(14)

Condenser Charge Coil Total _____**(84)**

Pulser Coil Tests (13 points each)

1. Setup multi-meter properly for test. _____(13)
2. Performed pulser coil resistance tests as shown in materials _____(13)
3. Reached the proper conclusion on pulser coil condition _____(13)

Rectifier Test Total _____**(39)**

General (9 points each)

1. Completed technician worksheet. _____(9)
2. Properly used instructions, tools and followed procedures _____(9)

General Total _____**(18)**

(225 points possible) Grand Total _____

Skills USA Technician Worksheet

W/S#_____ Technician #_____

Condenser Charge Coil Test: (check boxes as completed)

- ☐ Setup multi-meter for proper scale to test
- ☐ Examine coil condition–cuts or damage to coil or insulation _____ OK / bad
- ☐ Perform resistance test on the condenser charge coil. _____ ohms
- ☐ Resistance reading is within specification _____ OK / bad
- ☐ Check for electrical short to bracket ground _____ OK / bad
- ☐ Condenser charge coil should be replaced _____ Yes / No

Battery Charge Coil Test: (check boxes as completed)

- ☐ Setup multi-meter for proper scale to test
- ☐ Examine coil condition–cuts or damage to coil or insulation _____ OK / bad
- ☐ Perform resistance test on the battery charge coil. _____ ohms
- ☐ Resistance reading is within specification _____ OK / bad
- ☐ Check for electrical short to bracket ground _____ OK / bad
- ☐ Battery charge coil should be replaced _____ Yes / No

Pulser Coil Test: (check boxes as completed)

- ☐ Setup multi-meter for proper scale to test
- ☐ Perform pulser coil resistance test.
- ☐ All resistance readings with specification _____ OK / bad
- ☐ Pulser coil should be replaced _____ Yes / No

Electrical Test Station Information

Suzuki DT40 Stator test specifications

Condensor Charge coil	**(Green - Black)**	
	Ω at 20° C	**200 ~ 300**
Battery Charge coil	**(Yellow - Red)**	
	Ω at 20° C	**.2 ~ .5**
Pulser coil	**(Red/White to ground)**	
	Ω at 20° C	**160 ~ 230**

SUZUKI MARINE

Electrical Test Station Information

Suzuki DT200 Stator test specifications

Condensor Charge coil	**(Green - Black/Red)**	
	Ω at 20° C	**200 ~ 300**
Battery Charge coil	**(Yellow - Red)**	
	Ω at 20° C	**.3 ~ .6**
Pulser coil	**(Red/Black - Black)**	
	Ω at 20° C	**160 ~ 230**

2010 Skills USA Championships
Marine Service Technology Contest

Workstation
PTT Electrical Troubleshooting
Judge's Scoresheet

Contestant # _____ Start Time: _____
Judge's Initials: _____ Stop Time: _____
Total Time: _____

Scoring Directions- *Unless otherwise specified,* the performance of each skill should be "0, 5, 10 or 30" using the following criteria.

"0" indicates that the contestant **could not** perform this skill.
A "5, 10 or 30" indicates that the contestant **could** perform this skill.

I. PERFORMANCE:

1. Check red pan switch wire voltage (12V)	____ (0,10)
2. Check red remote switch wire voltage (12V)	____ (0,10)
3. 0 volts – check fuse next	____ (0,10)
4. Switch bypass – PTT goes up	____ (0,10)
5. Switch bypass – PTT goes down	____ (0,10)
6. If jump works, switch is bad	____ (0,10)
7. Switch up mode – 12V on blue wire	____ (0,10)
8. Switch down mode – 12V on green wire	____ (0,10)
9. Relay ground lead – no resistance	____ (0,10)
10. Jump blue lead – motor turns over	____ (0,10)
11. If motor turns over – motor good, bad relay	____ (0,10)
12. If motor doesn't turn over – bad motor, good relay	____ (0,10)
13. Problem #1 – open in blue wire from remote switch	____ (0,30)
14. Problem #2 – green wire to down relay open	____ (0,30)
15. Problem #3 – ground wire (black) to relays open	____ (0,30)

16. **JOB SKILLS:**

Used tools safely and properly.	_____ (0,10)
Cleaned and organized the work area.	_____ (0,5)

POSSIBLE SCORE: ***225 pts.*** **TOTAL** _____

2010 Skills USA Championships

Marine Service Technology Contest

Contestant Worksheet

Contestant # _____

In this task, you will be working on the Power Trim &Tilt (PTT) electrical system. You have two tasks in this lab. First, do the electrical checks listed in your worksheet on this system while it is working normally. This will give you some familiarity with normal readings.

Second, you will "bug" the system. Your job will be to use the troubleshooting list to find the problem. You may use the materials on your table for reference.

Normal Operation
The unit should operate normally at this point. Try both switches and make sure they both make the trim motor operate forward and backward. If you have operational problems, tell the judge now.

Using your materials, check each of the following components and write down your results.

1. Pan switch - check for voltage on the red wire going to the switch. What do you find?

_____

2. Remote switch - check its red wire for voltage. What do you find?

_____

3. If there was 0 volts on the red wire, where would you look next?

_____

4. Switch bypass - take a jumper and go between the red wire and sky-blue wire at each switch. What happens?

_____

5. Now make the same test between the red wire and the light-green wire. What happens?

_____

6. Looking at the results of steps 4 and 5, if the switch wouldn't activate the motor, but the jump did, what does that tell you about the switch?

---

7. Click either switch into the "up" mode. What voltage reading do you get on the sky-blue wire at the "up" relay?

---

8. Perform the same test, but this time click either switch into "down" mode. What voltage reading do you get on the light-green wire at the "down" relay?

---

9. Relay ground lead - check the black ground wires to each relay for continuity to ground. What resistance reading should you get?

---

10. Disconnect the Blue motor lead on the relay and touch it to the positive post on the relay. Does the motor turn over?

---

11. If the motor turns over, what does that tell you?

---

12. If the motor didn't turn over, what would that tell you?

PT&T Electrical System Problems
"Bugged" System

The following tasks involve PT&T problems. You will be given a customer's description of the problem. Find the problem. Use your reference materials to troubleshoot the system.

Do not try to fix the problems you find. Fill in the steps you take to find each problem. If a component is bad, write down your findings. If you find that a section of wire is bad, write down the location, such as "break in the wire between the switch and relay."
After completing each problem, move the problem switch to the up position.

Problem #1 – Move SW1 to the down position
Customer Jones complains that when under way, he can't get the motor to go up when he hits the trim up switch. Write down the steps you take to find the p
roblem.

_____

_____

_____

Problem #2 – Move SW2 to the down position
Customer Smith complains that no matter what he does, the motor won't come down once he has trimmed it up. He ends up having to use the manual release valve to lower it. Write down your troubleshooting steps.

_____

_____

_____

Problem #3 – Move SW3 to the down position
Customer Brown states that the system won't work at all. He can't get any up or down movement. Write down your troubleshooting steps.

_____

_____

_____

When finished, return the paperwork and equipment to its original position.

Instructions for Skills USA Marine Technologies Test

Description of Test

1. Tappet clearance measurement.

You must use the service materials and tools provided to properly measure and record all tappet clearances on this DF40 Four Stroke Suzuki outboard cylinder head. You must complete the appropriate section of the worksheet provided as you do the job. You will be awarded points for each step you perform and completion of the worksheet.

2. Tappet clearance adjustment.

You must determine from your worksheet which tappets require adjustment. Using the service materials and tools provided, perform a tappet clearance adjustment on all tappets not within specification for this DF40 Four-Stroke Suzuki outboard cylinder head. You must complete the appropriate section of the worksheet provided as you do the job. You will be awarded points for each step you perform and completion of the worksheet.

Skills USA Test Evaluation Form

Work Station #____ Technician #_____

Tappet Clearance Inspection (14 points each)

1. Read the instructions carefully. Choose proper thickness gauge. _____(14)
2. Positioned camshaft nose 180^0 to tappet shim before inspection. _____(14)
3. Checked all valve tappet clearances. _____(14)
4. Measured exact clearances if not using GO-NO-GO gauges. _____(14)
5. Recorded clearances on worksheet. . _____(14)
6. Determined correct number of tappets with incorrect clearance _____(14)

Tappet clearance inspection Total _____**(84)**

Tappet clearance adjustment (15 points each)

1. Positioned cam nose 180^0 to shim of incorrect clearance tappets _____(15)
2. Properly removed shims using Suzuki tappet depressor & retainer _____(15)
3. Determined and recorded correct replacement shims _____(15)
4. Properly installed replacement shims _____(15)
5. Properly removed tappet retainer tool _____(15)
6. Use thickness gauge to recheck tappet clearance _____(15)

Tappet clearance Adjustment Total _____**(90)**

General (51 points total)

1. Properly used instructions, tools and followed procedures. _____(13)
2. Completed technician worksheet. _____(13)
3. Technician's work habits – cleanliness – organization. _____(13)
4. Technician's overall attitude – enthusiasm. _____(12)

General Total _____**(51)**

(225 points possible) Grand Total _____

TAPPET SHIM SELECTION CHART

Shim I.D. No. / Present shim size (mm) / Tappet clearance (mm)	218	220	222	224	226	228	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300
	2.18	2.20	2.22	2.24	2.26	2.28	2.30	2.32	2.34	2.36	2.38	2.40	2.42	2.44	2.46	2.48	2.50	2.52	2.54	2.56	2.58	2.60	2.62	2.64	2.66	2.68	2.70	2.72	2.74	2.76	2.78	2.80	2.82	2.84	2.86	2.88	2.90	2.92	2.94	2.96	2.98	3.00
0.00 – 0.04										218	220	222	224	226	228	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282
0.05 – 0.09								218	220	222	224	226	228	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286
0.10 – 0.14					218	220	222	224	226	228	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292
0.15 – 0.17			218	220	222	224	226	228	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296
0.18 – 0.24	SPECIFIED CLEARANCE / NO ADJUSTMENT REQUIRED																																									
0.25 – 0.29	224	226	228	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300			
0.30 – 0.34	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300						
0.35 – 0.39	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300								
0.40 – 0.44	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300											
0.45 – 0.49	244	246	248	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300													
0.50 – 0.54	250	252	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																
0.55 – 0.59	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																		
0.60 – 0.64	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																					
0.65 – 0.69	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																							
0.70 – 0.74	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																										
0.75 – 0.79	274	276	278	280	282	284	286	288	290	292	294	296	298	300																												
0.80 – 0.84	280	282	284	286	288	290	292	294	296	298	300																															
0.85 – 0.89	284	286	288	290	292	294	296	298	300																																	
0.90 – 0.94	290	292	294	296	298	300																																			
0.95 – 0.99	294	296	298	300																																						

1. Measure tappet clearance “Engine cold”.
2. Measure present shim size.
3. Match clearance in vertical column with present shim size in horizontal column

[EXAMPLE]
Tappet clearance is — 0.35 mm
Present shim size — 2.40 mm
Shim size to be used — 2.56 mm

Skills USA Technician Worksheet

W/S#_____ Technician #_____

Tappet clearance inspection: (check boxes as completed)

- ☐ Setup GO / NO-GO gauge
- ☐ Position #1 cylinder exhaust camshaft nose 90^0 to tappet shim
- ☐ Check #1 cylinder exhaust valve tappet clearance
- ☐ Measure exact clearance if not within GO / NO-GO specification
- ☐ Record clearance on worksheet
- ☐ Continue clearance inspection of #1cylinder intake valve tappets and exhaust / intake valve tappets for cylinders #2 and #3

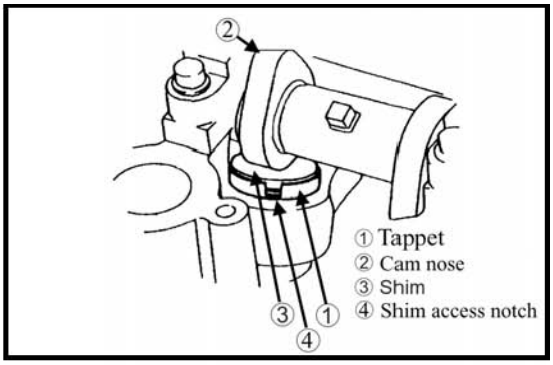
Number of tappets requiring clearance adjustment? None____ # (1~12)_____

Tappet clearance adjustment: (check boxes as completed)

- ☐ Position camshaft nose 90^0 to shim of tappet with incorrect clearance
- ☐ Use Suzuki tappet depressor and retainer to remove tappet shim
- ☐ Determine shim required for proper tappet clearance from shim selection chart and record selection on worksheet
- ☐ Install selected shim into tappet
- ☐ Remove tappet retainer and tappet depressor
- ☐ Use GO / NO-GO gauge to check tappet clearance after installing selected shim
- ☐ Repeat procedure for any tappet you determined to have incorrect clearance
- ☐ Return workstation to as found condition

TAPPET CLEARANCE ADJUSTMENT PROCEDURE SHEET

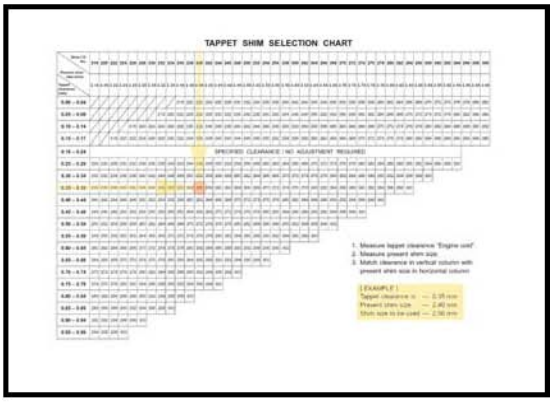
1 Use 23mm open end wrench to turn cam-shaft until cam nose on tappet requiring shim adjustment is at 180° from the tappet shim.



2 Remove the shim from the tappet which you determined had incorrect tappet clearance.

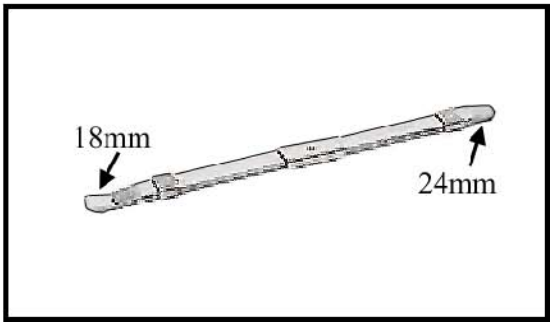
NOTE:
Follow the procedure in the tappet depressor instruction sheet.

1 Using the measured tappet clearance from your worksheet and the thickness of the tappet shim you removed, determine the correct shim for proper clearance from the shim selection chart.



2 Select the correct clearance shim from the shim box, install the shim into the tappet and remove the tapper retainer tool.

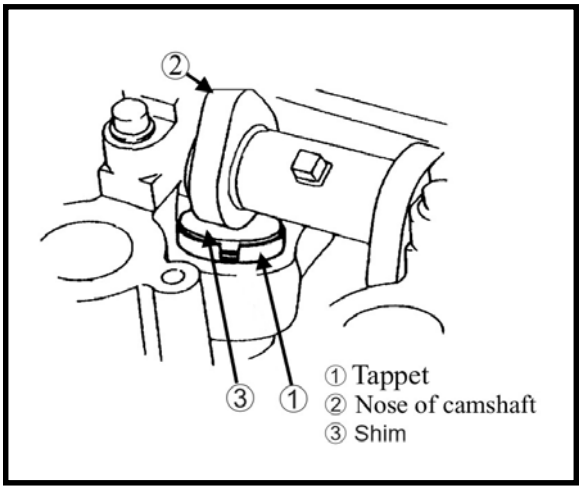
3 Measure clearance after installing the selected clearance shim using the GO / NO-GO gauge. Change worksheet to “OK” if clearance measurement is within specification.



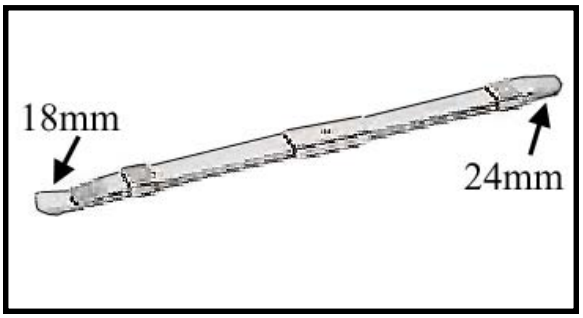
4 Repeat tappet clearance adjustment procedure for all tappets which you determined had incorrect clearance.

TAPPET CLEARANCE MEASUREMENT PROCEDURE SHEET

Tappet clearance (cold engine)
IN. : 0.18 – 0.24 mm (0.007 – 0.009 in.)
EX. : 0.18 – 0.24 mm (0.007 – 0.009 in.)

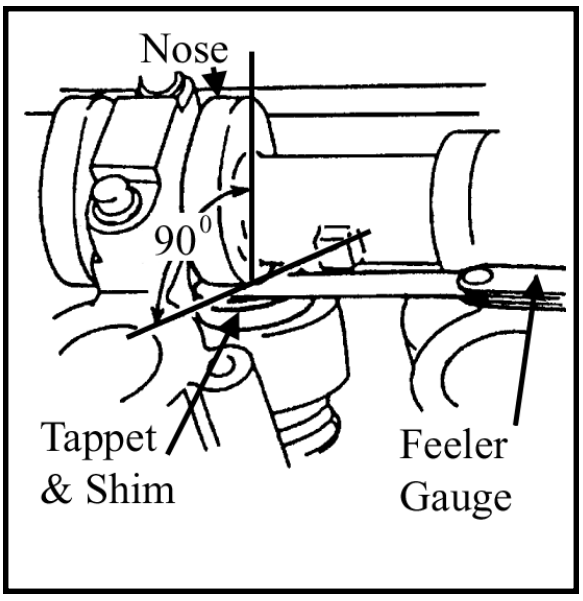


1. Use 23mm open end wrench to turn camshaft until cam nose on the cylinder to be checked is at 90° from the tappet shim.



2. Use Go / No-Go gauge to measure tappet clearance by inserting gauge between base circle of cam and tappet shim.

   If 18mm end is loose and 24mm end is tight or will not fit, mark worksheet as OK for that tappet's clearance.

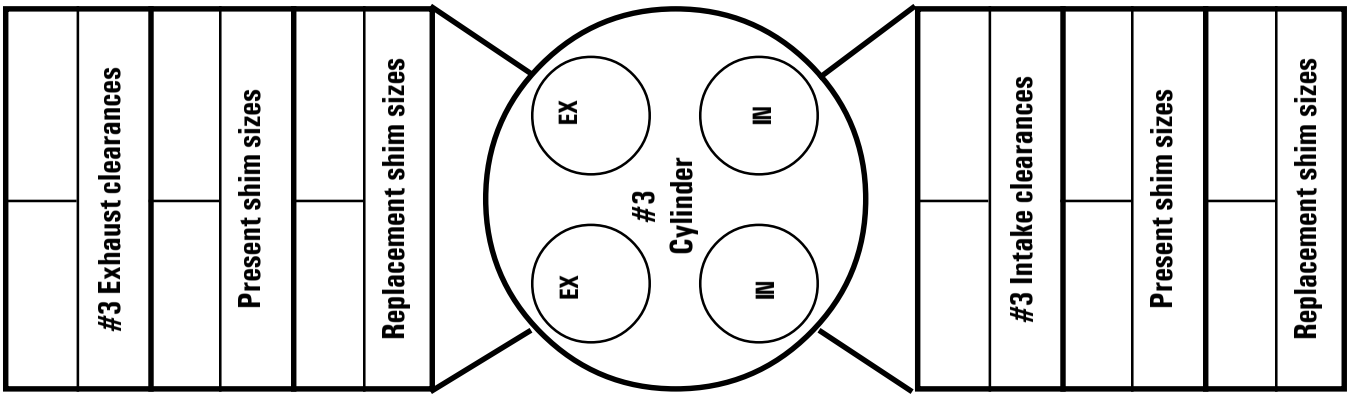


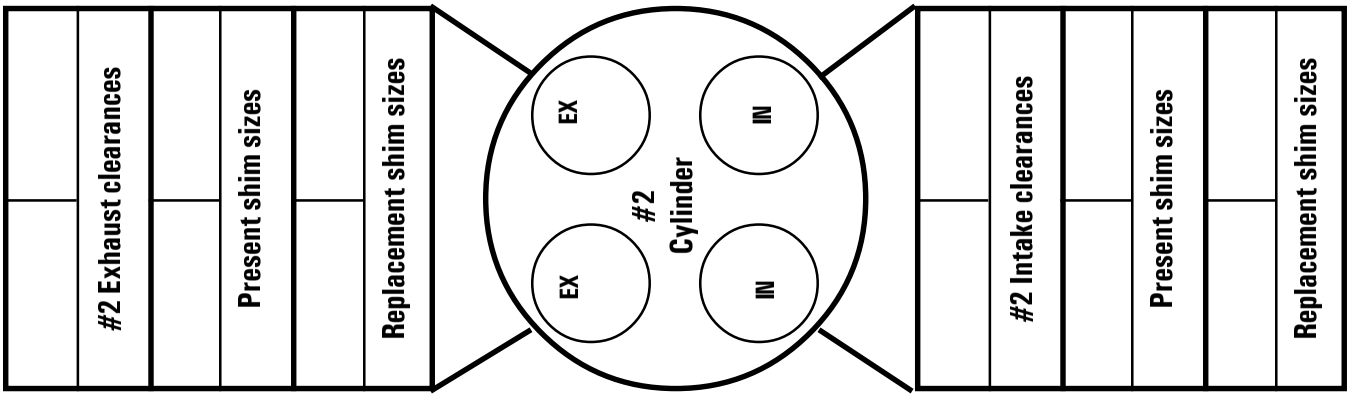
3. Use feeler gauge to determine exact tappet clearance for any tappet which does not meet the Go / No-Go specification.

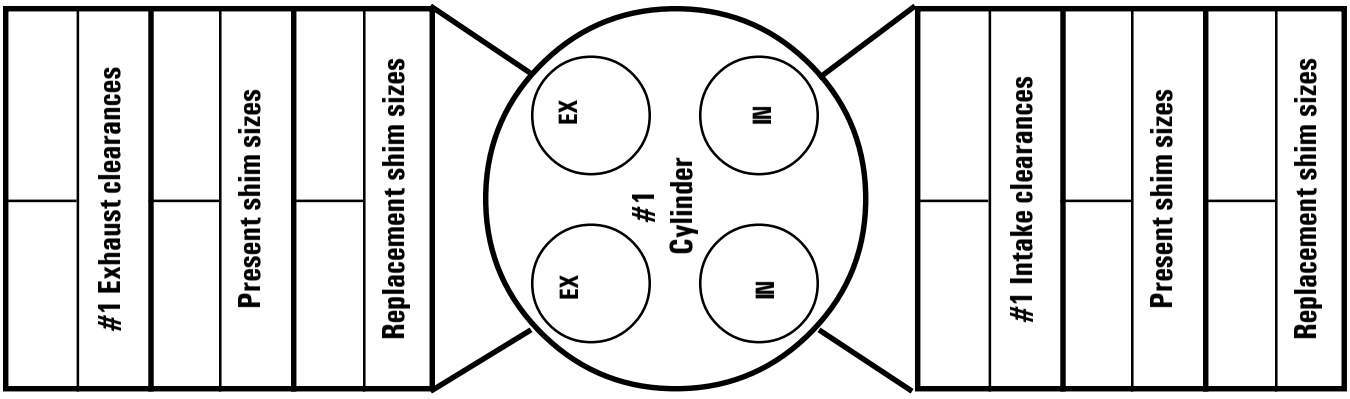
   Mark exact clearance on worksheet.

SKILLS USA Technician Worksheet

W/S#_____ Technician #_____







TAPPET DEPRESSOR INSTRUCTION SHEET

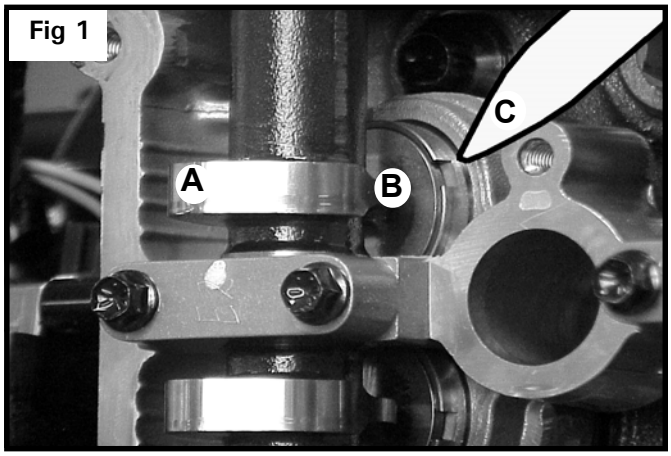
VALVE SHIM REPLACEMENT PROCEDURE:

1. Rotate the camshaft until the cam nose "A" faces 180-degrees away from the tappet shim "B" (Fig 1).

2. Rotate the tappet body until the shim access notch "C" faces towards center of cylinder head (Fig 1).

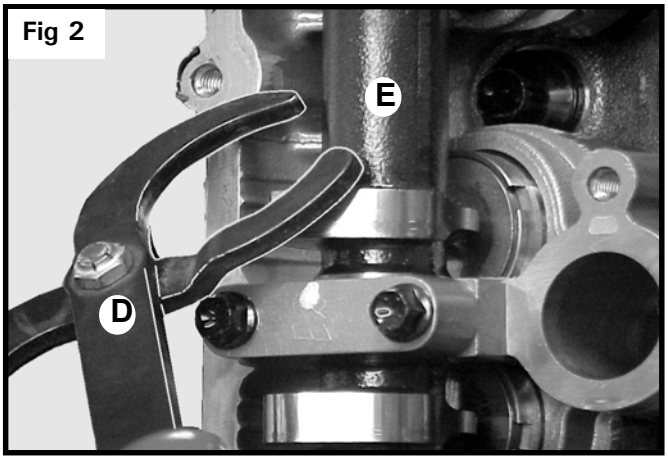
   The notch in the tappet provides access to the shim edge to lift and remove.

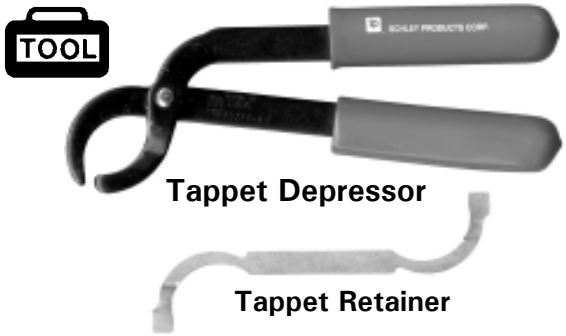
Fig 1



3. Place depressor tool "D" over camshaft "E" with the single curve jaw of the tool towards outside of cylinder head (Fig 2).

Fig 2





4. Squeeze the depressor tool handles together (slightly depresses the tappet), then rotate the depressor tool towards the center of the cylinder head to completely depress the tappet. (Fig 3 & 4).

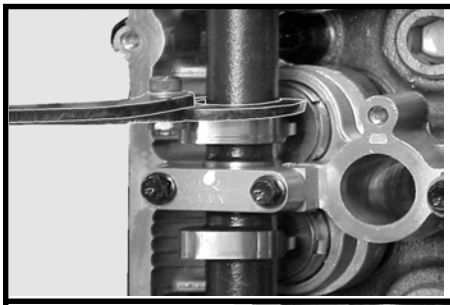


Fig 3

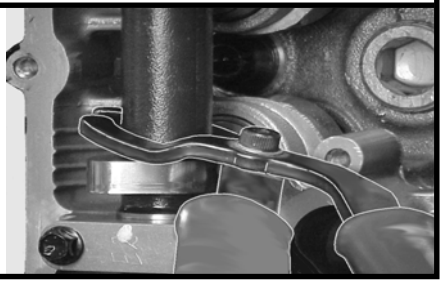


Fig 4

NOTE

The tappet must be fully depressed (below flush with cylinder head tappet bore) before inserting the tappet retainer tool.

5. Place the tappet retainer tool "F" between outer rim of tappet and camshaft holder to hold tappet in the depressed position (Fig 5).

   Once the retainer is in place, remove the depressor tool.

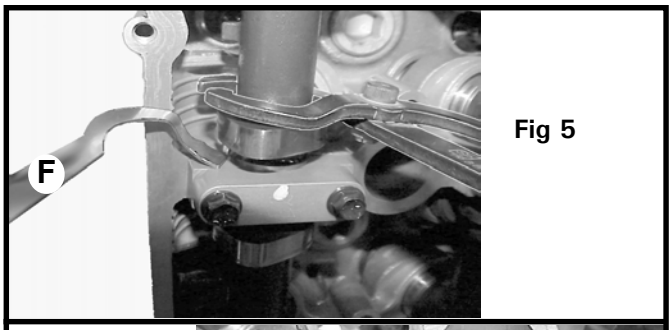


Fig 5

NOTE

When placing the retainer tool on the edge of the tappet, make sure the tool is not touching the shim (Fig 6, camshaft removed for better view). This would prevent removal of the shim "G".

Each end of the retainer tool is shaped differently to fit the upper and lower tappets of each cylinder.

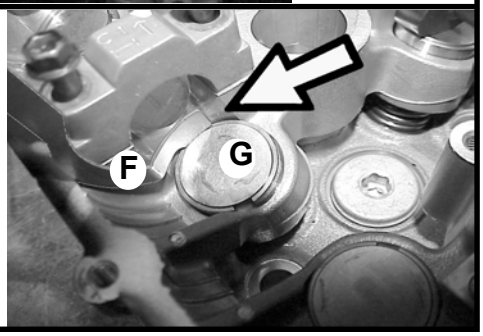


Fig 6

6. Use a forceps / small screwdriver / magnet to pick out the shim. Read the size number "H" or measure the shim's thickness with a micrometer or caliper to determine the size (Fig 7).

   Use the shim selection table to chose a replacement shim which will provide the proper tappet clearance.

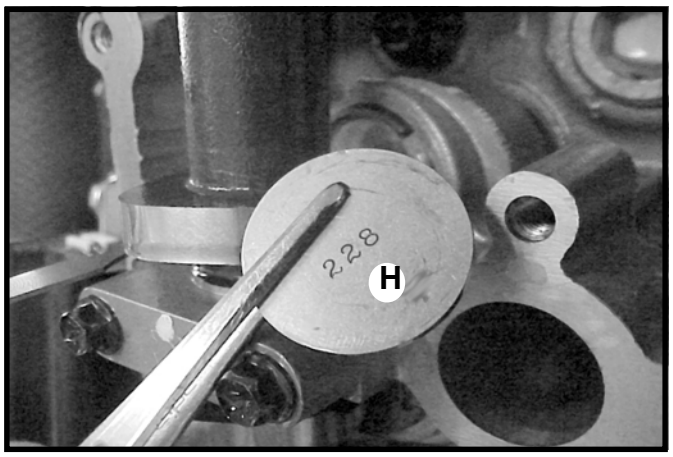


Fig 7

NOTE

Install the replacement shim with the size mark towards the tappet. This prevents the camshaft lobe from wearing the number off the shim.

Apply clean engine oil to the shim so it will adhere to the tappet during installation.

7. After installing the replacement shim, use the depressor tool to depress the tappet and remove the retainer tool.

   DO NOT REMOVE THE RETAINER TOOL WITHOUT FIRST DEPRESSING THE TAPPET.

   Rotate the engine at least one full revolution and measure again to verify correct tappet clearance (repeat procedure if necessary to acheive proper clearance). Repeat this procedure for all tappets which require shim replacement to adjust clearance.