

# **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)

Work Station # \_\_\_\_\_

# Boat PDI List

Contestant # \_\_\_\_\_

<input type="checkbox"/>	1	_____
<input type="checkbox"/>	2	_____
<input type="checkbox"/>	3	_____
<input type="checkbox"/>	4	_____
<input type="checkbox"/>	5	_____
<input type="checkbox"/>	6	_____
<input type="checkbox"/>	7	_____
<input type="checkbox"/>	8	_____
<input type="checkbox"/>	9	_____
<input type="checkbox"/>	10	_____
<input type="checkbox"/>	11	_____
<input type="checkbox"/>	12	_____
<input type="checkbox"/>	13	_____
<input type="checkbox"/>	14	_____
<input type="checkbox"/>	15	_____
<input type="checkbox"/>	16	_____
<input type="checkbox"/>	17	_____
<input type="checkbox"/>	18	_____
<input type="checkbox"/>	19	_____
<input type="checkbox"/>	20	_____
<input type="checkbox"/>	21	_____
<input type="checkbox"/>	22	_____
<input type="checkbox"/>	23	_____
<input type="checkbox"/>	24	_____
<input type="checkbox"/>	25	_____

Work Station # \_\_\_\_\_

# Trailer PDI List

Contestant # \_\_\_\_\_

<input type="checkbox"/>	1	_____
<input type="checkbox"/>	2	_____
<input type="checkbox"/>	3	_____
<input type="checkbox"/>	4	_____
<input type="checkbox"/>	5	_____
<input type="checkbox"/>	6	_____
<input type="checkbox"/>	7	_____
<input type="checkbox"/>	8	_____
<input type="checkbox"/>	9	_____
<input type="checkbox"/>	10	_____
<input type="checkbox"/>	11	_____
<input type="checkbox"/>	12	_____
<input type="checkbox"/>	13	_____
<input type="checkbox"/>	14	_____
<input type="checkbox"/>	15	_____
<input type="checkbox"/>	16	_____
<input type="checkbox"/>	17	_____
<input type="checkbox"/>	18	_____
<input type="checkbox"/>	19	_____
<input type="checkbox"/>	20	_____
<input type="checkbox"/>	21	_____
<input type="checkbox"/>	22	_____
<input type="checkbox"/>	23	_____
<input type="checkbox"/>	24	_____
<input type="checkbox"/>	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

<b>Condensor Charge coil</b>	<b>(Green - Black)</b>
	<b><math>\Omega</math> at 20° C          200 ~ 300</b>
<b>Battery Charge coil</b>	<b>(Yellow - Red)</b>
	<b><math>\Omega</math> at 20° C          .2 ~ .5</b>
<b>Pulser coil</b>	<b>(Red/White to ground)</b>
	<b><math>\Omega</math> at 20° C          160 ~ 230</b>



## Electrical Test Station Information

### Suzuki DT200 Stator test specifications

<b>Condensor Charge coil</b>	<b>(Green - Black/Red)</b>
	<b><math>\Omega</math> at 20° C          200 ~ 300</b>
<b>Battery Charge coil</b>	<b>(Yellow - Red)</b>
	<b><math>\Omega</math> at 20° C          .3 ~ .6</b>
<b>Pulser coil</b>	<b>(Red/Black - Black)</b>
	<b><math>\Omega</math> at 20° C          160 ~ 230</b>

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?

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

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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?

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

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

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

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

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# 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 problem.

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### **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.

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### **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.

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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<sup>0</sup> 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<sup>0</sup> 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.	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
Present shim size (mm)	/																																									
Tappet clearance (mm)	/																																									
<b>0.00 – 0.04</b>	/																																									
<b>0.05 – 0.09</b>	/																																									
<b>0.10 – 0.14</b>	/																																									
<b>0.15 – 0.17</b>	/																																									
<b>0.18 – 0.24</b>	/																																									
<b>0.25 – 0.29</b>	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			
<b>0.30 – 0.34</b>	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						
<b>0.35 – 0.39</b>	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								
<b>0.40 – 0.44</b>	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											
<b>0.45 – 0.49</b>	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													
<b>0.50 – 0.54</b>	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																
<b>0.55 – 0.59</b>	254	256	258	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																		
<b>0.60 – 0.64</b>	260	262	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																					
<b>0.65 – 0.69</b>	264	266	268	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																							
<b>0.70 – 0.74</b>	270	272	274	276	278	280	282	284	286	288	290	292	294	296	298	300																										
<b>0.75 – 0.79</b>	274	276	278	280	282	284	286	288	290	292	294	296	298	300																												
<b>0.80 – 0.84</b>	280	282	284	286	288	290	292	294	296	298	300																															
<b>0.85 – 0.89</b>	284	286	288	290	292	294	296	298	300																																	
<b>0.90 – 0.94</b>	290	292	294	296	298	300																																				
<b>0.95 – 0.99</b>	294	296	298	300																																						

### SPECIFIED CLEARANCE / NO ADJUSTMENT REQUIRED

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° 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 #1 cylinder intake valve tappets and exhaust / intake valve tappets for cylinders #2 and #3

Number of tappets requiring clearance adjustment? None \_\_\_\_\_ # (1~12) \_\_\_\_\_

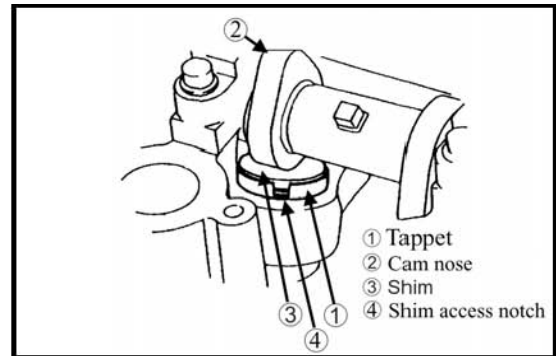
**Tappet clearance adjustment:** (check boxes as completed)

- Position camshaft nose 90° 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 camshaft 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 taper retainer tool.

TAPPET SHIM SELECTION CHART	
Camshaft Tappet Clearance (mm)	Shim Thickness (mm)
0.00 - 0.04	0.00 - 0.04
0.05 - 0.09	0.05 - 0.09
0.10 - 0.14	0.10 - 0.14
0.15 - 0.19	0.15 - 0.19
0.20 - 0.24	0.20 - 0.24
0.25 - 0.29	0.25 - 0.29
0.30 - 0.34	0.30 - 0.34
0.35 - 0.39	0.35 - 0.39
0.40 - 0.44	0.40 - 0.44
0.45 - 0.49	0.45 - 0.49
0.50 - 0.54	0.50 - 0.54
0.55 - 0.59	0.55 - 0.59
0.60 - 0.64	0.60 - 0.64
0.65 - 0.69	0.65 - 0.69
0.70 - 0.74	0.70 - 0.74
0.75 - 0.79	0.75 - 0.79
0.80 - 0.84	0.80 - 0.84
0.85 - 0.89	0.85 - 0.89
0.90 - 0.94	0.90 - 0.94
0.95 - 0.99	0.95 - 0.99
1.00 - 1.04	1.00 - 1.04
1.05 - 1.09	1.05 - 1.09
1.10 - 1.14	1.10 - 1.14
1.15 - 1.19	1.15 - 1.19
1.20 - 1.24	1.20 - 1.24
1.25 - 1.29	1.25 - 1.29
1.30 - 1.34	1.30 - 1.34
1.35 - 1.39	1.35 - 1.39
1.40 - 1.44	1.40 - 1.44
1.45 - 1.49	1.45 - 1.49
1.50 - 1.54	1.50 - 1.54
1.55 - 1.59	1.55 - 1.59
1.60 - 1.64	1.60 - 1.64
1.65 - 1.69	1.65 - 1.69
1.70 - 1.74	1.70 - 1.74
1.75 - 1.79	1.75 - 1.79
1.80 - 1.84	1.80 - 1.84
1.85 - 1.89	1.85 - 1.89
1.90 - 1.94	1.90 - 1.94
1.95 - 1.99	1.95 - 1.99
2.00 - 2.04	2.00 - 2.04
2.05 - 2.09	2.05 - 2.09
2.10 - 2.14	2.10 - 2.14
2.15 - 2.19	2.15 - 2.19
2.20 - 2.24	2.20 - 2.24
2.25 - 2.29	2.25 - 2.29
2.30 - 2.34	2.30 - 2.34
2.35 - 2.39	2.35 - 2.39
2.40 - 2.44	2.40 - 2.44
2.45 - 2.49	2.45 - 2.49
2.50 - 2.54	2.50 - 2.54
2.55 - 2.59	2.55 - 2.59
2.60 - 2.64	2.60 - 2.64
2.65 - 2.69	2.65 - 2.69
2.70 - 2.74	2.70 - 2.74
2.75 - 2.79	2.75 - 2.79
2.80 - 2.84	2.80 - 2.84
2.85 - 2.89	2.85 - 2.89
2.90 - 2.94	2.90 - 2.94
2.95 - 2.99	2.95 - 2.99
3.00 - 3.04	3.00 - 3.04
3.05 - 3.09	3.05 - 3.09
3.10 - 3.14	3.10 - 3.14
3.15 - 3.19	3.15 - 3.19
3.20 - 3.24	3.20 - 3.24
3.25 - 3.29	3.25 - 3.29
3.30 - 3.34	3.30 - 3.34
3.35 - 3.39	3.35 - 3.39
3.40 - 3.44	3.40 - 3.44
3.45 - 3.49	3.45 - 3.49
3.50 - 3.54	3.50 - 3.54
3.55 - 3.59	3.55 - 3.59
3.60 - 3.64	3.60 - 3.64
3.65 - 3.69	3.65 - 3.69
3.70 - 3.74	3.70 - 3.74
3.75 - 3.79	3.75 - 3.79
3.80 - 3.84	3.80 - 3.84
3.85 - 3.89	3.85 - 3.89
3.90 - 3.94	3.90 - 3.94
3.95 - 3.99	3.95 - 3.99
4.00 - 4.04	4.00 - 4.04
4.05 - 4.09	4.05 - 4.09
4.10 - 4.14	4.10 - 4.14
4.15 - 4.19	4.15 - 4.19
4.20 - 4.24	4.20 - 4.24
4.25 - 4.29	4.25 - 4.29
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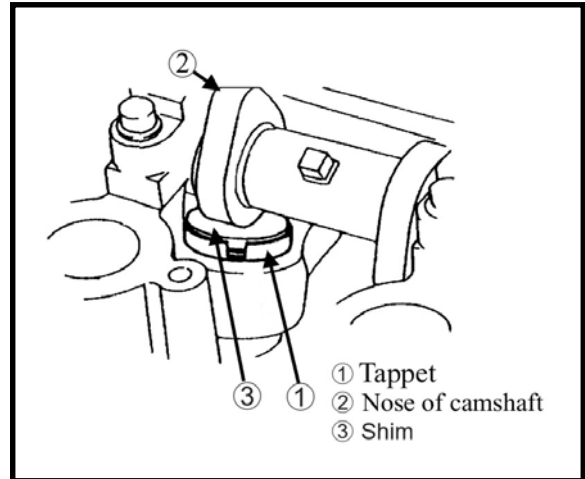
## TAPPET CLEARANCE MEASUREMENT PROCEDURE SHEET

**Tappet clearance ( cold engine )**

**IN. : 0.18 – 0.24 mm (0.007 – 0.009 in.)**

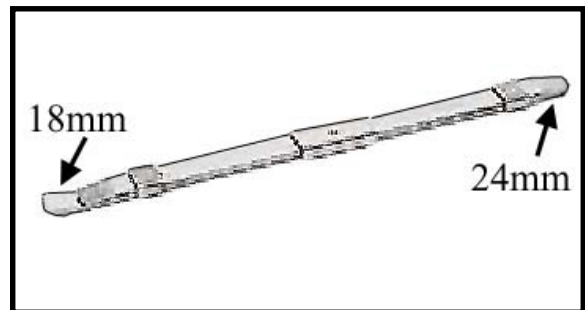
**EX. : 0.18 – 0.24 mm (0.007 – 0.009 in.)**

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.



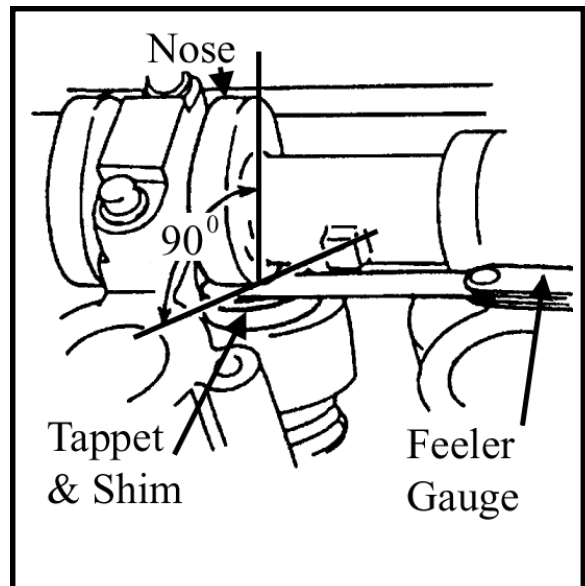
2. Use Go / No-Go gauge to measure tappet clearance by inserting gauge between base circle of cam and tappet shim.

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 # \_\_\_\_\_

<b>#1 Exhaust clearances</b>	
<b>Present shim sizes</b>	
<b>Replacement shim sizes</b>	

**#1  
Cylinder**

<b>#1 Intake clearances</b>	
<b>Present shim sizes</b>	
<b>Replacement shim sizes</b>	

<b>#2 Exhaust clearances</b>	
<b>Present shim sizes</b>	
<b>Replacement shim sizes</b>	

**#2  
Cylinder**

<b>#2 Intake clearances</b>	
<b>Present shim sizes</b>	
<b>Replacement shim sizes</b>	

<b>#3 Exhaust clearances</b>	
<b>Present shim sizes</b>	
<b>Replacement shim sizes</b>	

**#3  
Cylinder**

<b>#3 Intake clearances</b>	
<b>Present shim sizes</b>	
<b>Replacement shim sizes</b>	

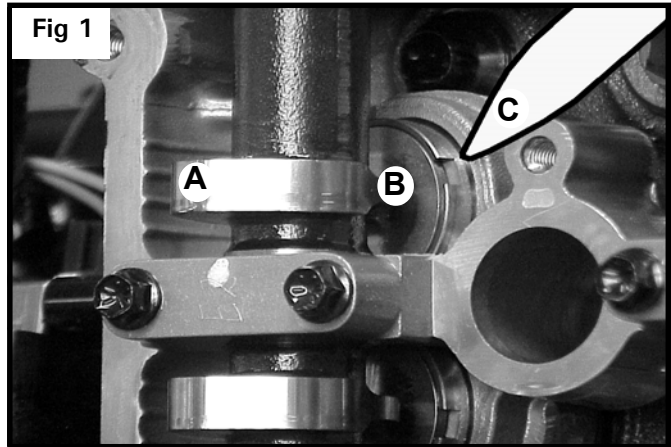


## TAPPET DEPRESSOR INSTRUCTION SHEET

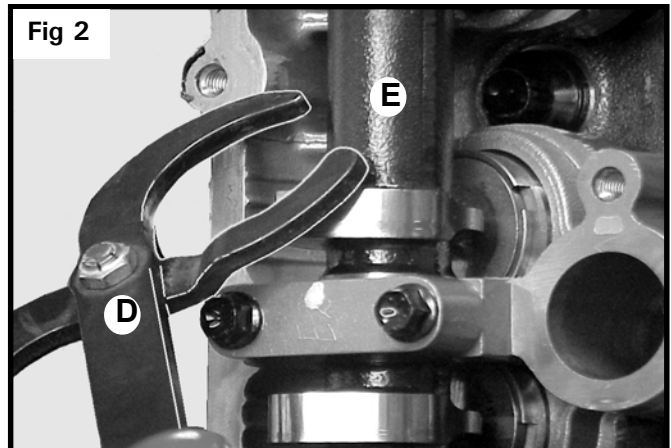
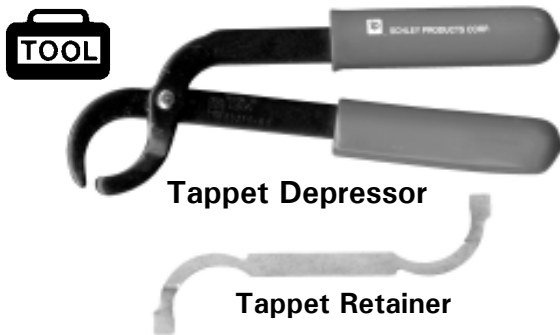
### VALVE SHIM REPLACEMENT PROCEDURE:

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).

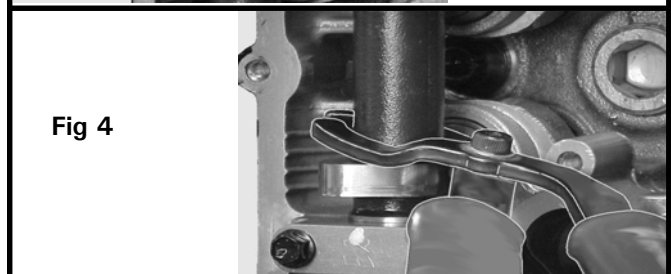
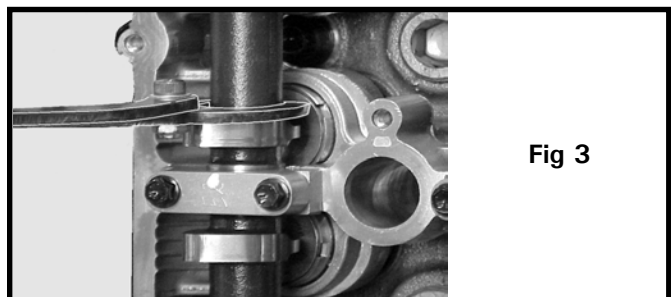
The notch in the tappet provides access to the shim edge to lift and remove.



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



### NOTE

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

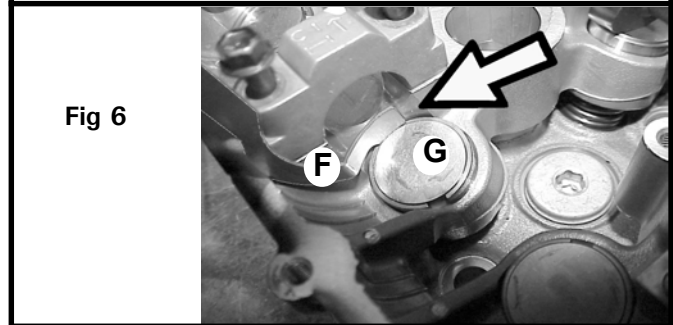
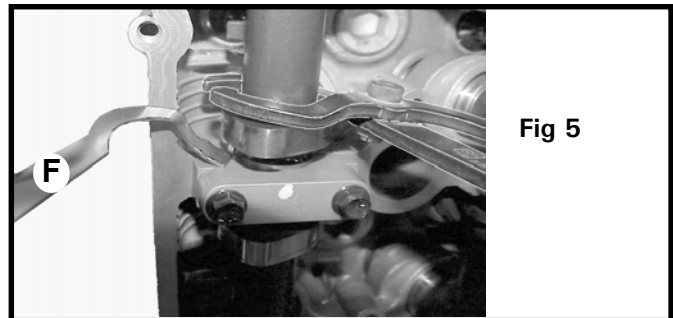
5. Place the tappet retainer tool "F" between outer rim of tappet and camshaft holder to hold tappet in the depressed position (Fig 5).

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

#### 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.



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 choose a replacement shim which will provide the proper tappet clearance.

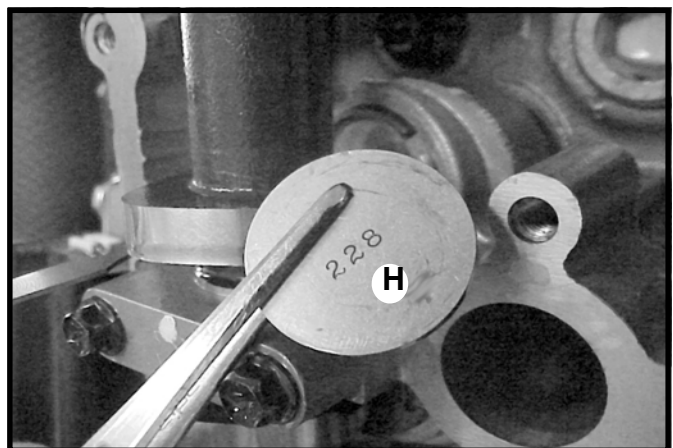


Fig 7

#### 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 achieve proper clearance). Repeat this procedure for all tappets which require shim replacement to adjust clearance.