

# SM Section Mill Field Inspection Manual

## Contents

Page	
P2	Scope
P2	References
P2	Terms and Abbreviations
P2	General Requirements for Inspection
P3	Model Range and Nomenclature
P4-P5	Body Inspection
P6	Top Sub Inspection
P7	Milling Arm Inspection
P8	Milling Arm Socket Inspection
P8	Milling Arm Pin Inspection
P9	Arm Stop Stabiliser Inspection
P10-P13	Piston Component Inspection
P14-P15	Flotel Component Inspection
P16	Jetting Insert Inspection



# SM Section Mill Field Inspection Manual

## Scope

These field inspection instructions apply to the Pioneer Oil Tools range of section mills. They provide guidance in accordance with API RP 7G-2.

## References

API RP 7G-2 Recommended practice for inspection and classification of used drill stem elements.  
API 7-2 Specification for threading and gauging of rotary shouldered thread connections.  
DS-1 Drill Stem Inspection.

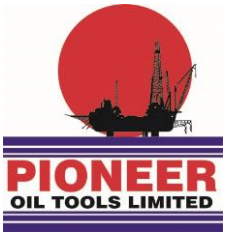
## Terms and Abbreviations

Terms and definitions are as per API RP 7G-2 section 3, API 7-2 section 4 and DS-1 volume 3.

## General Requirements for Inspection.

The provisions of API RP 7G-2 and API 7-2 hold where applicable.

- The inspection should take place in a suitable environment, with components being inspected at table height. Tubular components should be arrayed in a single layer and be able to freely roll round 360 deg. Lighting should be at 538 lx minimum intensity externally and 1076 lx for in bore inspection (prefer 1076 for both). This should be verified by light meter. Documentation and records pertaining to the inspection should be available prior to starting.
- Confirm the serial numbers of the components are as expected prior to beginning inspection.
- Only calibrated measuring equipment should be used. All measurement equipment used shall have its calibration status checked prior to use.
- The tools should be stripped down to component level as per disassembly instructions.
- The components should be cleaned thoroughly and dried prior to inspection. Surfaces should be prepared for NDT.
- Components should be de-magnetized after magnetic particle inspection. Fluids should be removed.
- Inspection results for all components should be detailed in a report.
- For any reportable discrepancy the inspection report should be forwarded for engineering review, and the relevant component placed into quarantine until a disposition is arrived at.
- Note that weld repair of 'mill' string member components is prohibited by API 7G-2

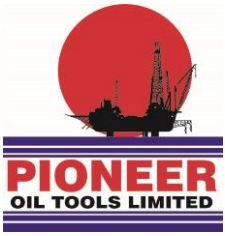


## SM Section Mill Field Inspection Manual

### Model Range & Nomenclature

Assembly Numbers	Description	Quantity Mill Arms	Assembly Numbers	Description	Quantity Mill Arms
SM0350(V)	3 1/2" Section Mills	3	SM0725(V)	7 1/4" Section Mills	6
SM0363(V)	3 5/8" Section Mills	3	SM0825(V)	8 1/4" Section Mills	6
SM0413(V)	4 1/8" Section Mills	6	SM0925(V)	9 1/4" Section Mills	6
SM0450(V)	4 1/2" Section Mills	6	SM1150(V)	11 1/2" Section Mills	8
SM0550(V)	5 1/2" Section Mills	6	SM1175(V)	11 3/4" Section Mills	8
SM0575(V)	5 3/4" Section Mills	6	SM1650(V)	16 1/2" Section Mills	8

Variant (V)	Differentiating Features
– (Base)	Slot stabilisers
A Model	Ring stabiliser, top sub jetting.
B Model	Slot stabilisers, top sub jetting.
C Model	Slot stabilisers, top sub Jetting, piston bore choke.
D Model	Slot stabilisers, top sub Jetting, bottom jetting, bore jet, float valve recess.
E Model	Slot stabilisers, top sub jetting & chip breaking, bottom jetting, bore jet, float valve recess.



# SM Section Mill Field Inspection Manual

## Body Inspection

### List of Body Part Numbers

Part Number	Part Number	Part Number	Part Number
SM0350-01	SM0363-01	SM0413-01	SM0450-01
SM0450A-01	SM0450D-01	SM0550-01	SM0550D-01
SM0575-01	SM0725B-01	SM0825-01	SM0825-01B
SM0825A-01	SM0825D-01	SM0825E-01	SM0925-01
SM1150-01	SM1150-01B	SM1150A-01	SM1150D-01
SM1175-01	SM1175A-01	SM1650-01	

### Outer Diameter

The entire outer surface should be visually inspected for cuts, dents, gouges, washout and pits. Any found > 1/16" deep (in line with the milling arm pin holes) or 1/8" deep (otherwise) are cause for rejection. Identify damage for dressing. Burrs and rough areas on the OD should be identified for later dressing (with a suitable file).

The entire outer surface should also be inspected using MPI techniques to DS-1 (3.15) and corresponding acceptance criteria therein. Any cracking is cause for rejection. Note that weld repair is prohibited.

### Inner Diameter

Ensure that internal surfaces are inspected for damage, wear or washout. Pitting deeper than 1/8" deep is cause for rejection. Bore washout is cause for rejection.

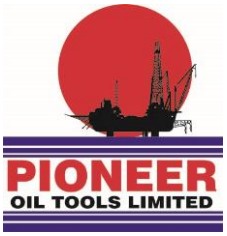
Identify any damage to seal running / sealing surfaces for later dressing (with fine emery). Un-rectifiable damage to seal running / sealing surfaces is cause for rejection. Pitting to seal running / sealing surfaces is cause for rejection.

[Versions D & E]

Jetting Holes should be inspected for washout and thread damage, minor thread damage (burrs etc) can be dressed with a suitable honing stone, any substantial washout is cause for rejection.

[Version E Section Mills]

Inspect the through bore where it meets the bore jet housing for any washout, any substantial washout is cause for rejection. Ensure the circlip groove bisecting the seal running surface is burr free.



## SM Section Mill Field Inspection Manual

### Body Inspection (continued)

#### Connections

Connections should be checked for damage (box swelling, shoulder galling, thread fretting, stress cracking and minor damage). Identify any damage. Severe connection damage is cause for rejection. Minor damage may be dressed with a suitable file or honing stone.

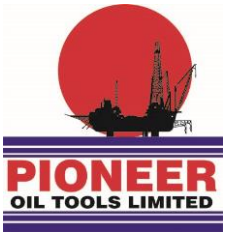
All thread connections are to be inspected to DS-1 (3.11) and corresponding acceptance criteria therein.

#### Slots & Pin Holes

Minor damage to milling arm slots should be flagged for dressing. Significant material removal from slots either through washout or gross damage is cause for rejection.

Each slot should be checked using MPI techniques. Any cracking is cause for rejection.

Knife pin holes should be checked for cracking with MPI techniques. Any cracking is cause for rejection.



# SM Section Mill Field Inspection Manual

## Top Sub Inspection

### List of Top Sub Part Numbers

Part Number	Part Number	Part Number	Part Number
SM0350A-02	SM0363-02A	SM0413-02	SM0413A-02
SM0450-02	SM0450A-02	SM0550-02	SM0550A-02
SM0550A-02A	SM0550A-02IF	SM0575-02	SM0575A-02
SM0725A-02	SM0825-02	SM0825A-02	SM0825A-02A
SM0825A-02B	SM0825A-02C	SM0825E-02	SM0925A-02
SM1150-02	SM1150A-02	SM1150A-02B	SM1650A-02

### Outer Diameter

The entire outer surface should be visually inspected for cuts, dents, gouges, washout and pits. Any found > 1/4" deep are cause for rejection. Identify damage for dressing. Burrs and rough areas on the OD should be identified for later dressing (with a suitable file).

The entire outer surface should also be inspected using MPI techniques to DS-1 (3.15) and corresponding acceptance criteria therein. Any cracking is cause for rejection. Note that weld repair is prohibited.

[Version E Section Mills]

Inspect the threaded holes for thread damage and or washout. Minor damage may be identified for re-dressing, major damage is cause for rejection.

### Inner Diameter

Ensure that internal surfaces are inspected for damage, wear or washout. Pitting deeper than 1/8" deep is cause for rejection. Bore washout is cause for rejection

[Versions B, C, D & E Section Mills]

Jetting Holes should be inspected for washout and thread damage, minor thread damage (burrs etc) can be dressed with a suitable honing stone, any substantial washout is cause for rejection. Identify any damage to sealing groove edges for later dressing (with fine emery). Un-rectifiable damage to groove edges is cause for rejection.



# SM Section Mill Field Inspection Manual

## Milling Arm Inspection

### List of Milling Arm Part Numbers Carbide Cutting Insert Style

Part Number	Part Number	Part Number	Part Number	Part Number
SM0350A-03	SM0363A-03	SM0413A-03	SM0450A-03	SM0450A-03X
SM0550A-03	SM0725A-03	SM0825A-03	SM0925A-03	SM1150A-03
SM1650A-03				
SM0413A-04	SM0450A-04	SM0450A-04X	SM0550A-04	SM0725A-04
SM0825A-04	SM0925A-04	SM1150A-04	SM1650A-04	

### Tungsten Carbide Mesh Style

SM0550A-03A	SM0825A-03A	SM1150-03		
SM0550A-04A	SM0825A-04A	SM1150-04		

Long milling arms (-03 Components) Short milling arms (-04 Components)

For best result use fresh milling arms for every trip especially the opening cut, however in sub-optimal circumstances or as a cost saving measure the operator may choose to use worn but useable milling arms as an alternative.

### Carbide Cutting Insert Milling Arms

Where assessing the usability check for:

- Gross damage / extreme wear is reason for rejection and should also be recorded as such (a deeply worn channel, bending, etc).
- Cracking within two diameters of the pivot hole or in the base metal alone is reason for rejection
- Cracking in the hard-facing metal exceeding 3/32" wide by 0.25" long is reason for rejection
- Cracking in the hard-facing metal extending into the base metal exceeding overall length of 0.094" (smaller than 5.5" mills) 0.125" (5.5 & 5.75" mills) or 0.135" (8.25 and larger mills) is reason for rejection
- The number of consumed insert rows (record for engineering assessment of future viability).
- The condition of the opening cut edge (record missing structure for engineering assessment).

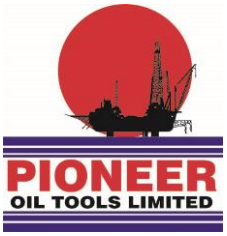
If hardness testing equipment is available hardness test the back of the blade opposite the inserts: minimum of 14 HRc for continued viability.

### Crushed Carbide Matrix Style Milling Arms

Where assessing the usability check for:

- Gross damage / extreme wear is reason for rejection and should also be recorded as such (a deeply worn channel, bending, etc).
- Cracking within two diameters of the pivot hole is reason for rejection
- Cracking in the hard-facing metal exceeding 3/32" wide by 0.25" long is reason for rejection
- Cracking in the hard-facing metal extending into the base metal exceeding overall length of 0.094" (smaller than 5.5" mills) 0.125" (5.5 & 5.75" mills) or 0.135" (8.25 and larger mills) is reason for rejection
- Report the extent of the milling arm opening cut wear and wear in the main body of the matrix for engineering assessment.

## Milling Arm Socket Inspection



## SM Section Mill Field Inspection Manual

### List of Milling Arm Sockets Part Numbers

Part Number	Part Number	Part Number	Part Number
SM0350-05	SM0363-05	SM0413-05	SM0450-05
SM0550-05	SM0725-05	SM0825-05	SM0925-05
SM1150-05			

Check for gross damage – reason for rejection.

Additionally the milling arm socket radius should be circular (note not a full hemisphere) however if wear has removed substantial material then this is cause for rejection.

### Milling Arm Pin Inspection

#### List of Milling Arm Pin Part Numbers

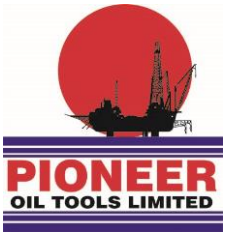
Part Number	Part Number	Part Number	Part Number
SM0350-07	SM0363-07	SM0413-07	SM0450-07
SM0550-07	SM0825-07A	SM1650-07	

Inspect pin straightness, any bending in the pins is reason for rejection (0.0xx” TIR max).

Inspect for material removal on the pin OD.

Note: egregious pin bending may be a tell-tale for milling arm socket wear and would generally be accompanied by pin OD wear, which otherwise should not happen.





# SM Section Mill Field Inspection Manual

## Arm Stop Stabilizer Inspection

### List of Arm Stop Stabilizer Part Numbers Individual Style

Part Number	Part Number	Part Number	Part Number
SM0350-06	SM0363-06	SM0413-06	SM0450-06
SM0550-06	SM0725-06	SM0825-06	SM0925-06
SM1150-06			

### Ring Style (type C mills)

SM0450A-06	SM0550A-06	SM0825A-06	SM1150A-06
------------	------------	------------	------------

### Individual Arm Stop Stabilizers

Gross damage is cause for rejection.

Bending of the stabilizer is cause for rejection.

MPI to detect any cracking around the screw holes, which is cause for rejection.

Substantial uniform material removal from the stabilizer surface is cause for rejection, though minor scoring is acceptable.

### Ring Style Arm Stop Stabilizer

Gross damage is cause for rejection.

Check threads for damage, minor damage (burrs & nicks) should be identified for dressing with a suitable hone stone. Un-rectifiable damage is cause for rejection.

Substantial uniform material removal from the raised stabilizer pads is cause for rejection, though minor scoring is acceptable.

MPI all accessible areas, cracking is cause for rejection.



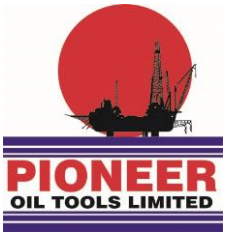
# SM Section Mill Field Inspection Manual

## Piston Component Inspection

### List of Piston Component Part Numbers

Part Number	Part Number	Part Number	Part Number	Part Number	Part Number
Piston					
SM0363-21	SM0413-21	SM0450-21	SM0550-21	SM0725-21	SM0825-21
SM1150-21	SM1650-21	SM0550C-21	SM0825C-21	SM1150C-21	
Piston Choke (type C pistons)					
SM0825-29					
O-ring (type C pistons)					
SM0825-29A					
Valve Seat					
SM0363-22	SM0450-22	SM0550-22	SM0825-22	SM1650-22	
Circlip (valve seat retainer)					
SM0363-24	SM0450-24	SM0550-24	SM0825-24	SM1150-24	SM1650-24
Valve Seat Seal					
SM0363-26	SM0450-26	SM0550-26	SM0825-26	SM1150-26	SM1650-26
Piston Seal					
SM0363-25	SM0413-25	SM0450-25	SM0550-25	SM0825-25	SM1150-25
SM1650-25					
Retaining Ring					
SM0363-27	SM0413-27	SM0450-27	SM0550-27	SM0825-27	SM1150-27
SM1650-27					
Circlip (piston seal retainer)					
SM0363-28	SM0413-28	SM0450-28	SM0550-28	SM0825-28	SM1150-28
SM1650-28					
Return Spring					
SM0275-23	SM0363-23	SM0413-23	SM0450-23	SM0550-23	SM0825-23
SM1150-23	SM1150-23A	SM1650-23			
SM1150/ SM1175 / SM1650 Only					
Spring Housing			Spring Thrust Ring		
SM1150-29	SM1150-29A	SM1650-29	SM1150-30	SM1650-30	
Seal Sleeve			Sleeve O-ring		
SM1150-31	SM1650-31		SM1150-32	SM1650-32	

† SM1150-23A/29A spring/spring housing makes SM1150-23/29 obsolescent from September 2023.



## SM Section Mill Field Inspection Manual

### Piston Component Inspection (Continued)

#### Pistons

Gross damage is cause for rejection.

Inspect for washout in the bore and top surface area surrounding the valve seat, washout is cause for rejection.

Identify any damage to seal running / sealing surfaces for later dressing (with fine emery). Un-rectifiable damage to seal running / sealing surfaces is cause for rejection. Pitting to seal running / sealing surfaces is cause for rejection.

[Type C pistons]

Check the threaded connection for damage, identify minor damage for dressing with a suitable honing stone. Major damage is cause for rejection.

#### Piston Choke [type C Pistons]

Gross damage is reason for rejection.

Identify any damage to seal running / sealing surfaces for later dressing (with fine emery). Un-rectifiable damage to seal running / sealing surfaces is cause for rejection. Pitting to seal running / sealing surfaces is cause for rejection.

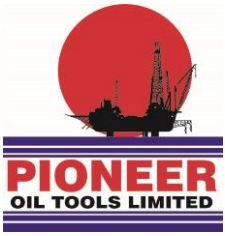
Check threads for damage. Any minor damage that can be dressed with a hone stone should be marked as such. Otherwise thread damage is cause for engineering assessment.

Excessive wear or plastic deformation to the torquing slots is cause for rejection.

Check for washout in the piston choke bore, any signs of which is cause for rejection.

#### O-ring [type C Pistons]

If not replacing, test under tension and magnification for any cracking, which is cause for rejection. Similarly any mechanical damage (abrasion, rips, tears, etc.) is cause for rejection.



## SM Section Mill Field Inspection Manual

### Piston Component Inspection (Continued)

#### Valve Seat

Gross damage is cause for rejection.

Check for washout, any is cause for rejection.

#### Circlip (valve seat retainer)

Gross damage is cause for rejection.

#### Valve Seat Seal

If not replacing, test under tension and magnification for any cracking, which is cause for rejection. Similarly any mechanical damage (abrasion, rips, tears, etc.) is cause for rejection.

#### Piston Seal

If not replacing, test under tension and magnification for any cracking, which is cause for rejection. Similarly any mechanical damage (abrasion, rips, tears, etc.) is cause for rejection. Heavy wear in the thrust ring groove width is cause for rejection.

#### Retaining Ring (for piston seal)

Gross mechanical damage is cause for rejection. Burrs and other minor damage should be marked for later dressing by the use of fine emery.

#### Circlip (for retaining ring)

Gross damage is cause for rejection.



# SM Section Mill Field Inspection Manual

## Piston Component Inspection (Continued)

### Return Spring

Note the wire drawing process can leave a surface texture that is not completely smooth. This is identifiable as very faint raised threads running parallel to the helix path. This is acceptable for the return spring.

Gross damage is cause for rejection. Check for corrosion hot spots beyond light surface rust. Cavities of any dimension are cause for rejection.

Check the spring for any scoring on the working coil surfaces; scores/gouges > 0.010" (0.25mm) is cause for rejection.

The spring free length at minimum should be as shown; any shorter is cause for rejection.

### Minimum Spring Free Lengths

Part Number	Minimum free length	Part Number	Minimum free length
SM0363-23	9.25"		
SM0413-23	9.25"		
SM0450-23	9.25"		
SM0550-23	11"		
SM0825-23	16"		
SM1150-23	19.25"	SM1150-23A†	16.210"
SM1650-23	19.75"		

† Design in use from Sept 2023 (SM1150-23 obsolescent from the same date).

### Spring Housing (larger section mills)

Gross damage is cause for rejection.

### Spring Thrust Ring (split ring, larger section mills)

Gross damage is cause for rejection.

### Seal Sleeve (larger section mills)

Identify any burrs and nicks for dressing with a suitable file or emery (on the sealing face). Gross damage is cause for rejection.

### Sleeve O-ring (larger section mills)

If not replacing, test under tension and magnification for any cracking, which is cause for rejection. Similarly any mechanical damage (abrasion, rips, tears, etc.) is cause for rejection.



# SM Section Mill Field Inspection Manual

## Flotel Component Inspection

### List of Flotel Component Part Numbers

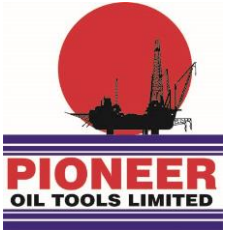
Part Number	Part Number	Part Number	Part Number	Part Number	Part Number
Flotel Lockscrew					
SM0450-32	SM0550-32	SM0825-32	SM1150-62		
Circlip					
SM0363-33	SM0413-33	SM0450-33	SM0550-33	SM0825-33	SM1150-63
SM1650-63					
Steel Balls					
SM0363-34	SM0413-34	SM0450-34	SM0550-34	SM0825-34	SM1150-64
SM1650-64					
Stop Pin					
SM0363-35	SM0413-35	SM0450-35	SM0550-35	SM0825-35	SM1150-65
SM1650-65					
Flotel Body, Spacer, Flotel Shaft, Flotel Sleeve and Conical nut are all fixed together: replace as one unit.					
Flotel Body					
SM0363-36	SM0413-36	SM0450-36	SM0550-36A	SM0825-36A	SM1150-66
SM1650-66					
Spacer					
SM0363-37	SM0450-37	SM0550-37A	SM0825-37A	SM1150-67	SM1650-67
Flotel Shaft					
SM0363-38	SM0450-38	SM0550-38A	SM0825-38A	SM1150-68	SM1650-68
Flotel Sleeve					
SM0363-39	SM0450-39	SM0550-39A	SM0825-39	SM1150-69	SM1650-69
Conical Nut					
SM0363-50	SM0450-50	SM0550-50	SM0825-50	SM1650-50	

### Flotel Lockscrew

Check threads for signs of damage, mark any minor damage for rectification with a suitable hone stone. Note these screws are not expected to be heavy duty, however check the socket head for any signs of torsion damage from abuse in fitting.

### Circlip

Gross damage is reason for rejection.



## SM Section Mill Field Inspection Manual

### **Steel Balls**

Check for missing balls, one per port in the flotel body.

### **Stop Pin**

Check for any bending which is cause for rejection.

### **Flotel Body**

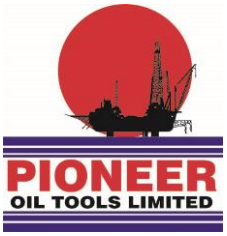
Check for washout in the three slots, any is cause for rejection. Major damage to the threads is cause for rejection. Mark any minor damage to the threads for later dressing, run through with a tap 3/8 UNC16 (SM0550 and smaller), 1/2 UNC13 (SM0725 and larger). Note extreme care should be taken not to break the tap in the hole otherwise spark eroding the hole clear will become necessary.

### **Conical Nut**

Check for washout, any is cause for rejection.

### **Spacer – Flotel Shaft – Flotel Sleeve**

Check for washout, any is cause for rejection.



## SM Section Mill Field Inspection Manual

### Jet Insert Inspection

Applies to all nozzles in section mill models A, B, C, D, E.

#### Jetting Nozzle

Check for any washout which is cause for rejection. Check for any burrs or minor damage to the thread and highlight for dressing with a suitable file. Any major damage to the threads or General gross damage is cause for rejection

#### O-ring

If not replacing, test under tension and magnification for any cracking, which is cause for rejection. Similarly any mechanical damage (abrasion, rips, tears, etc.) is cause for rejection.