Inspection Plan (Check Sheet) for FIAT Springs QM-C-8.1/SS Rounds/0003/FIAT

Item : Spring Steel Rounds (Black Bar)

Spec. : RDSO/2017/CG-01, Rev.01 of Aug-2019 with Corrigendum No.-01 of October, 2019 & Material- EN10089/ ISO- 683 Pt-14.

Drg. No.& Alt.:

1. Firm's Name:-
2. Date (period) of Inspection:-
3. Contract Details :-
   a. Contract no. and date:-
   b. Order placing authority:-
   c. Specification no.(as mentioned in contract):-
   d. Drawing no. (as mentioned in contract):-
4. Quantity on order:-
5. Quantity previously passed:-
6. Quantity offered for inspection on date:-
7. Quantity passed:-
8. Quantity balance after this:-
9. Consignee:-
10. Delivery Period:-
11. Documents Verification:
    a) Internal test reports/documents as per Approved QAP.
    b) Record of heat treatment cycle of Bars/Rods (Annealing, heat- treatment).
    c) Hydrogen (H2) & Nitrogen (N2) content as per clause no.4.3 & 5.1.2 of specification no. RDSO/2017/CG-01, Rev.01 with Corrigendum No.-01 of October, 2019.
    d) Test report of macro etching level shall not be worse than C2, R2, S2 of ASTM-381 plate 1 for blooms and billets.
    e) Calibration records of gauges, measuring instruments & testing equipment.

Sr. No.	SUMMARY OF RESULTS			
1.	Heat No. ----------	Bar/Rod size ----------mm	Material Gr.----------	
2.	Visual Check	As per clause no. 5.2.1.1 of specification No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.	Observation :----------	
3.	Dimensional check	As per Drawing No.----------	Observation : ----------	
4.	Microstructure	Annealed & free from "Primary" dendrite structure. As per clause no. 5.1.1 & 5.2.4.2 of specification No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.	Observation:----------	
5.	Grain Size	ASTM Size No.6 or finer. As per clause no. 5.2.4.2 of specification No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.	Max	Min
6.	Hardness	248 BHN Max (Annealed condition) for grade – 52SiCrNi5, 51CrV4 & 52CrMoV4, As per Table 6 of EN 10089.	Max	Min
7.	Depth of decarburization	(0.015 x Bar/rod dia.) Max. As per EN 10089 Grade-52SiCrNi5.	Max	Min
		(0.012 x Bar/rod Dia.) Max. As per ISO: 683 Pt-14, Grade- 51CrV4 and 52CrMoV4.	Max	Min
8.	Inclusion rating	Not worse than 1.5 A,B,C,D for both thick and thin series when compared to the chart for determining the inclusion content of secondary refined steels (Fig.2) of IS: 4163(latest). Alternatively, non-metallic inclusion at every heat may be checked by the steel procedure in accordance to ASTM E45. As per clause no. 5.2.4.2 of spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.	Max	Min
9.	Straightness	As per clause no. 6.2.2 of spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.	Ok/Not/Ok	
10.	Macro etching	As per clause no.5.2.4.1 of spec. No. RDSO/2017/CG-01, Rev.(01) with Corrigendum No.-01 of October, 2019.	Observation:----------	
11.	Reduction ratio	In hot rolling process, a minimum rolling reduction ratio of 16:1 As per clause no. 5.1.1 of spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019. In Ingot-forging-rolling route, minimum reduction ratio of 16:1 As per clause no. 5.1.2 of spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.	Observation:----------	

12.	**Chemical Composition: As per EN10089/ISO: 683 Pt-14 & spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.**											
	S. No.	**Material Grade**	**C%**	**Mn %**	**Si %**	**S % (Max.)**	**P% (Max.)**	**Cr %**	**V %**	**Mo %**	**Ni %**	**(Cu + Sn)%**
	1.	**51Cr V4**										
	Specified as per ISO 683 Part-14 Or EN10089 & RDSO/2017/CG-01, Rev.01 with Corrigendum No.-01 of October, 2019.		**0.4-0.55**	**0.70-1.10**	**0.40 max.**	**0.015 max.**	**0.015 max.**	**0.90-1.20**	**0.10-0.25**	**-**	**-**	**Cu+10 Sn±0.60**
	2.	**52CrMoV4**										
	Specified as per ISO 683 Parts - 14 Or EN10089 & RDSO/2017/CG-01, Rev.01 with Corrigendum No.-01 of October, 2019.		**0.4-0.56**	**0.70-1.10**	**0.40 Max.**	**0.015 max.**	**0.015 max.**	**0.90-1.20**	**0.14-0.20**	**0.20 - 0.30**	**-**	**Cu+10 Sn±0.60**
	3.	**52SiCrNi5**										
	Specified as per ISO 683 Part-14 Or EN10089 & RDSO/2017/CG-01, Rev.01 with Corrigendum No.-01 of October, 2019.		**0.49-0.56**	**0.70-1.00**	**1.20-1.50**	**0.015 max**	**0.015 max**	**0.70-1.00**	**-**		**0.50-0.70**	**Cu+10 Sn±0.60**

Note:

(i) Permissible deviation between specified analysis and product analysis shall be as per Table 4 of EN 10089.

(ii) In case of steel manufactured by electric, duplex or a combination of these processes routed through secondary refining furnace, the permissible limit of hydrogen and nitrogen contents in liquid steel shall be 2.0 ppm (Max.) and 0.007% (Max.) respectively.

(iii) In case of spring steel rounds manufactured through Ingot-forging-rolling route, hydrogen content shall be limited to 1.5 ppm (Max.) and nitrogen content shall be limited to 0.007% (Max.).

(iv) *For Permissible limit of hydrogen and nitrogen contents in steel, test certificates should be provided by the bar manufacturers during raw material stage. These test certificates should be checked by the inspecting official.*

1. Heat No. ---------- Bar/rod size---------- Material Gr. ----------

2. <u>Visual Checks for Defects:</u>

Sample Size: 2% of black bars per heat per section. Actual Sample:

S.N.	Sample No.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1.	Freedom from defects																		
2.	Marking																		
3.	Colour coding																		

S.N.	Sample No.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.
1.	Freedom from defects																		
2.	Marking																		
3.	Colour coding																		

S.N.	Sample No.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.
1	Freedom from defects																		
2	Marking																		
3	Colour coding																		

S.N.	Sample No.	55.	56.	57.	58.	59.	60.												
1.	Freedom from defects																		
2.	Marking																		
3.	Colour coding																		

Total nos. of defectives. -------

Please use following defect codes for visual check while filling up the check sheets:

0	No defect
1	Seams
2	Folds
3	Laps
4	Cracks
5	Deep Pits/Deep rooted seams
6	Longitudinal Grooves
7	Excessive scaling
8	Distortion
9	Twist
10	Wrinkling
11	Inclusions
12	Burned spots
13	Tool marks
14	Dent marks
15	Depressions from handling and transport
16	Kinks
17	No Marking
18	Marking at wrong location
19	In complete marking
20	In correct marking
21	No colour coding
22	Wrong colour coding
23	Colour coding at in correct location
24	In complete colour coding

3. Verification of Dimensional Tolerances:

Sample Size: 5 samples per heat per section. Heat No…….. Actual Sample:

S.N.	Sample No.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1	Length																		
2	Diameter																		

S.N.	Sample No.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.
1	Length																		
2	Diameter																		

S.N.	Sample No.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.	51.	52.	53.	54.
1	Length																		
2	Diameter																		

S.N.	Sample No.	55.	56.	57.	58.	59.	60.												
1	Length																		
2	Diameter																		

Total nos. of defectives. -------

Please use following defect codes while filling up the check sheets:

0 No defect

1 Excess Length, 2 Shorter Length, 3 Excess Diameter, 4 Lesser diameters.

4. Macro-examination:

Sample Size: 0.5% subject to min. of 5 bars per heat Heat No.……..Actual No. of Samples……

Specified value: Entire cross section should have even annealed structure with depth of rim decarburization not more than 0.4 mm.
(As per clause no. 5.2.4.2 of specification No. RDSO/2017/CG-01, (Rev. 01) with Corrigendum No.-01 of October, 2019.)

Sample No.	Observation
1	
2	
3	
4	
5	

5. Grain Size:

Sample Size: 3 bars per heat per section. Heat No… Actual Sample……

Value Specified: Average grain size of the bar shall be as ASTM no. 6 or finer.
(As per clause no. 5.2.4.2 of specification No. RDSO/2017/CG-01, (Rev. 01) with Corrigendum No.-01 of October, 2019.)

Sample No.	1	2	3	4	5
Average Grain Size (ASTM NO.)					
Defect Code					

Total nos. of defectives. -------

Defect Codes

0 No Defect , 1 Coarser than ASTM NO. 6

6. Hardness:

Sample size: 10 bars per heat (Test to ensure per section per heat treatment batches).

Actual Samples:

Value Specified: 248 BHN Max (Annealed condition) for grade – 52SiCrNi5, 51CrV4 & 52CrMoV4, As per Table 6 of EN 10089).

Sample No.	Material Grade	Heat No.	Bar Diameter	Dia. of Indentation			Hardness (BHN)	Defect code
				1st	2nd	Average		
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

Total nos. of defectives…….

Defects Code:

0 Hardness as specified, 1 Hardness more than specified, 2 Hardness less than specified.

7. Depth of Decarburization

Sample Size: 3 bars per heat per section. Heat No…….Size of section.....

Actual Sample:

Value Specified: (**As per EN 10089,** 0.015 x Diameter for 52SiCrNi5) mm max.
(**As per ISO: 683 Pt-14** 0.012 x Diameter for 51CrV4 & 52CrMoV4) mm max.

(**The total depth of decarburization, partial plus complete on the bar**)

Material Grade	Sample No.	Depth of Decarb	Defect code
	1		
	2		
	3		

Total nos. of defectives……

Defect codes

0 No Defect, 1 Depth of Decarb more than specified

8. Inclusion rating

Sample Size: 3 bars per heat per section. Heat No…… Size of section……

Actual Sample:

Value Specified: Not worse than 1.5 A,B,C,D for both thick and thin series when compared to the chart for determining the inclusion content of secondary refined steels (Fig.2) of IS: 4163(latest). Alternatively, non-metallic inclusion at every heat may be checked by the steel procedure in accordance to ASTM E45.

As per clause no. 5.2.4.2 of spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.

Sample No.	A		B		C		D	
	Thin	Thick	Thin	Thick	Thin	Thick	Thin	Thick
1.								
2.								
3.								
Defect code								

Total nos. of defectives----------

Defect Codes

0	No Defect		
1	Worse than Specified in A Thick Series	2	Worse than Specified in A Thin Series
3	Worse than Specified in B Thick Series	4	Worse than Specified in B Thin Series
5	Worse than Specified in C Thick Series	6	Worse than Specified in C Thin Series
7	Worse than Specified in D Thick Series	8	Worse than Specified in D Thin Series

9. Straightness:

Sample size: - 2 bars per heat per section Actual sample size:-

Value Specified: **As per clause no. 6.2.2 of specification No. RDSO/2017/CG-01, .Rev. (01) with Corrigendum No.-01 of October, 2019.**

S.N.	Sample No.	1	2
1.	OK/Not OK		

10. Macro-Etching :

Sample Size: 0.5% subject to min. of 5 bars per heat per section. Heat No…….

Actual Sample:

Value Specified: As per clause no. 5.2.4.1 of specification no **RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.**

Sample No.	**Observations**
1.	
2.	
3.	
4.	
5.	
Specified	**Free from inherent defects. In the cross-section (micro-section surface), no microscopic defects such as cavities, pores, seams, cracks or liquidations and non-metallic inclusions are permitted.**

11. Reduction Ratio: In hot rolling process, a minimum rolling reduction ratio of 16:1. (As per clause no. 5.1.1 of spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019).

In Ingot-forging-rolling route, minimum reduction ratio of 16:1. (As per clause no. 5.1.2 of spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019).

12. Chemical Composition.

Sample Size: 2 Samples per heat per section. Heat No……. Size of section……
Actual Sample:
Specified: **As per EN10089/ISO: 683 Pt-14 & spec. No. RDSO/2017/CG-01, Rev. (01) with Corrigendum No.-01 of October, 2019.**

S. No.	Material Grade	C%	Mn%	Si %	S % (Max.)	P% (Max.)	Cr %	V %	Mo %	Ni %	(Cu + Sn)%
1.	51Cr V4										
Specified as per ISO 683 Part-14 Or EN10089 & RDSO/2017/CG-01, Rev.01 with Corrigendum No.-01 of October, 2019.		0.47 - 0.55	0.70 - 1.10	0.40 max.	0.015 max.	0.015 max.	0.90 - 1.20	0.10 - 0.25	-	-	Cu+10 Sn±0.60
2.	52CrMoV4										
Specified as per ISO 683 Parts - 14 Or EN10089 & RDSO/2017/CG-01, Rev.01 with Corrigendum No.-01 of October, 2019.		0.48 - 0.56	0.70 - 1.10	0.40 Max.	0.015 max.	0.015 max.	0.90 - 1.20	0.14 - 0.20	0.20 - 0.30	-	Cu+10 Sn±0.60
3.	52SiCrNi5										
Specified as per ISO 683 Part-14 Or EN10089 & RDSO/2017/CG-01, Rev.01 with Corrigendum No.-01 of October, 2019.		0.49 - 0.56	0.70 - 1.00	1.20 - 1.50	0.015 max	0.015 max	0.70 - 1.00	-		0.50 - 0.70	Cu+10 Sn±0.60

Note: *(i) Permissible deviation between specified analysis and product analysis shall be as per Table 4 of EN 10089.*

(ii) In case of steel manufactured by electric, duplex or a combination of these processes routed through secondary refining furnace, the permissible limit of hydrogen and nitrogen contents in liquid steel shall be 2.0 ppm (Max.) and 0.007% (Max.) respectively.

(iii) In case of spring steel rounds manufactured through Ingot-forging-rolling route, hydrogen content shall be limited to 1.5 ppm (Max.) and nitrogen content shall be limited to 0.007% (Max.).

(iv) *For Permissible limit of hydrogen and nitrogen contents in steel, test certificates should be provided by the bar manufacturers during raw material stage. These test certificates should be checked by the inspecting official.*

Defect codes for Chemical Composition:

0	No Defect.	13	Mo Less than specification
1	C Less than specification.	14	Mo more than specification
2	C more than specification.		
3	Si Less than specification.		
4	Si more than specification.		
5	Mn Less than specification.		
6	Mn more than specification.		
7	S more than specification.		
8	P more than specification.		
9	Cr Less than specification.		
10	Cr more than specification.		
11	V Less than specification.		
12	V more than specification.		