

Description: Phase Shifter w. Permanent magnets				Product description Phase Shifter - Main Assembly			
Order No.: 504313		Customer: SLAC		Part/Drawing No.: 7103050653		Serial No.: 2410089	
To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
1	Document information Template: Test_504313_PhaseShifter.A						
	Author:	N/A	OK			OK	27/02/2024 DANA
	Reviewer:	N/A	OK			OK	04/03-2024 EBCH
2	Visual Inspection according to main drawing						
3	Magnet Arrays:						
4	Torque wrench check for magnet assembly According to drawing: 7103050655 & 7103050656						
	Verify torque wrench setting at torque transducer	2361-D	5	5Nm ±0,3Nm	Torque Transducer.	OK	04/11/2024 bgr
	Tightening torque for 10 x M5 bolts	N/A	OK	10 x M5 bolts fastened		OK	04/11/2024 bgr

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5	Magnet array (Upper) Numbers Only note (xxx) See dwg. 7103050656						
	SXRHE-VS(xxx) N	N/A	024			OK	04/11/2024 bgr
	SXRHE-HS(xxx) ↑	N/A	053			OK	04/11/2024 bgr
	SXRHE-VL(xxx) S	N/A	113			OK	04/11/2024 bgr
	SXRHE-HL(xxx) ↓	N/A	065			OK	04/11/2024 bgr
	SXRHE-VL(xxx) N	N/A	002			OK	04/11/2024 bgr
	SXRHE-HS(xxx) ↑	N/A	091			OK	04/11/2024 bgr
	SXRHE-VS(xxx) S	N/A	095			OK	04/11/2024 bgr
6	Magnet array (Lower) Numbers Only note (xxx) See dwg. 7103050655						

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	SXRHE-VS(xxx) N	N/A	013			OK	04/11/2024 bgr
	SXRHE-HS(xxx) ↑	N/A	075			OK	04/11/2024 bgr
	SXRHE-VL(xxx) S	N/A	018			OK	04/11/2024 bgr
	SXRHE-HL(xxx) ↓	N/A	010			OK	04/11/2024 bgr
	SXRHE-VL(xxx) N	N/A	035			OK	04/11/2024 bgr
	SXRHE-HS(xxx) ↑	N/A	098			OK	04/11/2024 bgr
	SXRHE-VS(xxx) S	N/A	120			OK	04/11/2024 bgr
7	Mechanical test: Without magnets						

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8	<p>Measure the parallelism of each girder by measuring the distance in 6 points (10mm from transverse edges (Z=±35mm), 10mm (X=-59mm), 69mm (X=0) and 100mm (X=31) from longitudinal edge). Enter the measured values.</p> <p>Measure at 3 gaps, 10mm (121mm without magnets), 50mm (161mm without magnets) and 100mm (211mm without magnets).</p> <p>Illustration can be found in "504313_ReferenceDoc"</p>						
	Z=-35, X=-59 at 121mm gap	2138-D	121.04	121mm ±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=-35, X=0 at 121mm gap	2138-D	121.03	121mm ±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=-35, X=31 at 121mm gap	2138-D	121.03	121mm ±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=35, X=-59 at 121mm gap	2138-D	121.00	121mm ±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=35, X=0 at 121mm gap	2138-D	120.99	121mm ±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL

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	Z=35, X=31 at 121mm gap	2138-D	120.99	121mm ±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Deviation max-min at 121mm:	Calculated	0.05	<0,1 mm		OK	18/06/2024 MMOL
	Z=-35, X=-59 at 161mm gap	2138-D	161.03	161mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=-35, X=0 at 161mm gap	2138-D	161.03	161mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=-35, X=31 at 161mm gap	2138-D	161.03	161mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=35, X=-59 at 161mm gap	2138-D	160.97	161mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=35, X=0 at 161mm gap	2138-D	160.97	161mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=35, X=31 at 161mm gap	2138-D	160.97	161mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Deviation max-min at 161mm:	Calculated	0.06	<0,1 mm		OK	18/06/2024 MMOL
	Z=-35, X=-59 at 211mm gap	2138-D	211.03	211mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=-35, X=0 at 211mm gap	2138-D	211.03	211mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL

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	Z=-35, X=31 at 211mm gap	2138-D	211.03	211mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=35, X=-59 at 211mm gap	2138-D	210.97	211mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=35, X=0 at 211mm gap	2138-D	210.97	211mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Z=35, X=31 at 211mm gap	2138-D	210.97	211mm±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Deviation max-min at 211mm:	Calculated	0.06	<0,1 mm		OK	18/06/2024 MMOL
9	Measure the distance between the lower girder and top of base plate. Illustration can be found in "504313_ReferenceDoc"						
	Gap set to 121mm	2138-D	121.00	121mm ±0,1mm	Gauge Blocks	OK	18/06/2024 MMOL
	Position of lower girder	2138-D	162.5	162,5±1	Gauge Blocks	OK	18/06/2024 MMOL
10	Mechanical test: With magnets						

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11	Adjust the gap to 10mm. Draw a 10mm ceramic block through the magnet gap and check that it can be pulled through the entire gap.						
	10mm ceramic block pulled through gap	2238-D	OK		Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
	Set offset parameters in motor and encoder software.	N/A	19.5549	Encoder raw Value		OK	15/08/2024 CSOJ
12	Set the gap to 100mm as indicated by the motor. Draw a 100.00 mm ceramic block through the magnet gap and check that it can be pulled through the entire gap.						
	100,00mm ceramic block pulled through gap	2238-D	OK		Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ

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13	Set the gap to 10mm. Open the gap to 15mm. Reset a dial gauge installed between the girders to zero. Close the gap to 10mm. Open the gap to 15mm and read the dial gauge. Repeat the measurements 3 times.						
	Initial dial setting	2238-D	15	15mm ±0,005mm	Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
	Measurement 1	2291-D	15	15mm ±0,007mm	Dial Indicator	OK	15/08/2024 CSOJ
	Measurement 2	2291-D	15.001	15mm ±0,007mm	Dial Indicator	OK	15/08/2024 CSOJ
	Measurement 3	2291-D	15.001	15mm ±0,007mm	Dial Indicator	OK	15/08/2024 CSOJ
	Max deviation	Calculated	0.001	<0,002mm		OK	15/08/2024 CSOJ

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14	Set the gap to 15mm. Close the gap to 10mm. Reset a dial gauge installed between the girders to zero. Open the gap to 15mm. Close the gap to 10mm and read the dial gauge. Repeat the measurements 3 times.						
	Initial dial setting	2238-D	10	10mm ±0,005mm	Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
	Measurement 1	2291-D	10.001	10mm ±0,007mm	Dial Indicator	OK	15/08/2024 CSOJ
	Measurement 2	2291-D	10.000	10mm ±0,007mm	Dial Indicator	OK	15/08/2024 CSOJ
	Measurement 3	2291-D	10.001	10mm ±0,007mm	Dial Indicator	OK	15/08/2024 CSOJ
	Max deviation	Calculated	0.001	<0,002mm		OK	15/08/2024 CSOJ
15	Mechanical test: Stop and switch settings						

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
16	Attempt to bring to Hard stop settings as close to 9.8/102,2mm as possible to increase adjustment range for limit and power switches.						
	Hard stop setting closed gap Set the gap to 9.84 ± 0.04 mm and adjust the Hard stop to reach the upper girder	2238-D	OK		Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
	Hard stop setting open gap Set the gap to $102.25 +0/-0.1$ mm and adjust the Hard stop to reach the lower girder	2238-D	OK		Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
17	Limit switch setting (encoder read gap where the switch activates) Motor speed 5mm/s Approach closed gap from gap position = 20mm						
	The gap "in" limit switch	2238-D	9.97	9,97mm $\pm 0,025$ mm	Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ

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No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	Encoder	N/A	19.52195	Encoder raw value		OK	15/08/2024 CSOJ
	The gap "in" power switch	2238-D	9.9	9,915mm ±0,03mm	Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
	Encoder	N/A	19.4661	Encoder raw value		OK	15/08/2024 CSOJ
18	Limit switch setting (encoder read gap where the switch activates) Motor speed 5mm/s Approach open gap from gap position = 90mm						
	The "out" limit switch	2238-D	100.5	100,5mm ±0,5mm	Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
	Encoder	N/A	110.1251	Encoder raw value		OK	15/08/2024 CSOJ

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	The "out" power switch	2238-D	101.5	101,6mm ±0,5mm	Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
	Encoder	N/A	111.1239	Encoder raw value		OK	15/08/2024 CSOJ
19	Brake test Set the gap to 10.5mm. Note the exact encoder reading. Turn off the power supply for the brake and the motor controller. Read the gap.						
	Gap initial setting	2238-D	10.5	10,5mm ±0,05mm	Function / Arbitrary Waveform Generator	OK	15/08/2024 CSOJ
	Encoder	N/A	20.0580	Encoder raw value		OK	15/08/2024 CSOJ
	Gap after power off	2291-D	10.496	10,5mm ±0,1mm	Dial Indicator	OK	15/08/2024 CSOJ
	Encoder	N/A	20.0545	Encoder raw value		OK	15/08/2024 CSOJ

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No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	Deviation of initial setting and after power off	Calculated	0.004	0mm ±0,05mm		OK	15/08/2024 CSOJ
20	Open/close speed test. Measured in seconds First article only!						
	Open to closed (40mm gap to 10mm gap)	N/A	6.5	<10s		OK	15/08/2024 CSOJ
	Closed to open (10mm gap to 40mm gap)	N/A	6.45	<10s		OK	15/08/2024 CSOJ
21	Magnetic test See drawing 7103050653 for magnetic center						
22	Stretch wire measurement:						

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	Stretch wire measurements at all gaps in x=-10 through x=10 in 2 mm steps. At all gaps shall both 1st and 2nd integral scans be performed Use seperate document for data logging, see "504313_ReferenceDoc" <ul style="list-style-type: none"> • 10 mm gap • 15 mm gap • 20 mm gap • 30 mm gap • 100,0 mm gap 	N/A	OK	Stretchwire measurement completed		OK	10/09/2024 PMHA
23	Hall probe measurements:						

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No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	Hall probe measurements at intermediate gaps. Before and after each measurement series, reference magnetic field and magnet array temperature must be logged in order to perform temperature correction. 600 mm scans. Use seperate document for data logging, see "504313_ReferenceDoc" <ul style="list-style-type: none"> • 10 mm gap • 15 mm gap • 20 mm gap • 30 mm gap • 100,0 mm gap 	N/A	OK	Hall probe gap measurement completed		OK	10/09/2024 PMHA

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	Hall probe Horizontal measurements. Before and after each measurement series, reference magnetic field and magnet array temperature must be logged in order to perform temperature correction. 600 mm scans. Use seperate document for data logging, see "504313_ReferenceDoc" <ul style="list-style-type: none"> • 10 mm gap (x=-2) • 10 mm gap (x=-1) • 10 mm gap (x=1) • 10 mm gap (x=2) • 30,0 mm gap (x=-2) • 30,0 mm gap (x=-1) • 30,0 mm gap (x=1) • 30,0 mm gap (x=2) 	N/A	OK	Hall probe Horizontal measurement completed		OK	10/09/2024 PMHA

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	Hall probe Vertical measurements. Before and after each measurement series, reference magnetic field and magnet array temperature must be logged in order to perform temperature correction. 600 mm scans. Use seperate document for data logging, see "504313_ReferenceDoc" <ul style="list-style-type: none"> • 10 mm gap (y=-0,2) • 10 mm gap (y=-0,1) • 10 mm gap (y=0) • 10 mm gap (y=0,1) • 10 mm gap (y=0,2) 	N/A	OK	Hall probe Vertical measurement completed		OK	10/09/2024 PMHA
24	Fiducial holes measurements, magnetic gap 10 mm						

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	Report uploaded	N/A	OK		Y:\DFYProjects\DFY5 04313_SLAC Phase Shifters\30 Technical\40 QA and Test results\FAT documentation\241 0089	OK	05/09/2024 csoj
25	Visual inspection See drawing 7103050653						
	Visual appearance	N/A	OK			OK	04/11/2024 bgr
	Labels attached as indicated by drawing	N/A	OK			OK	04/11/2024 bgr
	Varnistop applied to bolts.	N/A	OK			OK	04/11/2024 bgr
26	Data label						
	Data label added	N/A	OK	Label present		OK	04/11/2024 bgr

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27	Production control						
	Approved by	N/A	OK			OK	04/11/2024 bgr
28	Lead Engineer						
	Approved by	N/A	OK			OK	05/11/2024 DANA