

Description: <b>Phase Shifter w. Permanent magnets</b>				Product description <b>Phase Shifter - Main Assembly</b>			
Order No.: <b>504313</b>		Customer: <b>SLAC</b>		Part/Drawing No.: <b>7103050653</b>		Serial No.: <b>2410085</b>	
To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
<b>1</b>	<b>Document information Template: Test_504313_PhaseShifter.A</b>						
	Author:	N/A	OK			OK	27/02/2024 DANA
	Reviewer:	N/A	OK			OK	04/03-2024 EBCH
<b>2</b>	<b>Visual Inspection according to main drawing</b>						
<b>3</b>	<b>Magnet Arrays:</b>						
<b>4</b>	<b>Torque wrench check for magnet assembly According to drawing: 7103050655 &amp; 7103050656</b>						
	Verify torque wrench setting at torque transducer	2361-D	5	5Nm ±0,3Nm	Torque Transducer.	OK	23/08/2024 bgr
	Tightening torque for 10 x M5 bolts	2361-D	OK	10 x M5 bolts fastened	Torque Transducer.	OK	23/08/2024 bgr

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<b>5</b>	<b>Magnet array (Upper) Numbers Only note (xxx) See dwg. 7103050656</b>						
	SXRHE-VS(xxx) N	N/A	102			OK	23/08/2024 bgr
	SXRHE-HS(xxx) ↑	N/A	046			OK	23/08/2024 bgr
	SXRHE-VL(xxx) S	N/A	021			OK	23/08/2024 bgr
	SXRHE-HL(xxx) ↓	N/A	051			OK	23/08/2024 bgr
	SXRHE-VL(xxx) N	N/A	014			OK	23/08/2024 bgr
	SXRHE-HS(xxx) ↑	N/A	076			OK	23/08/2024 bgr
	SXRHE-VS(xxx) S	N/A	035			OK	23/08/2024 bgr
<b>6</b>	<b>Magnet array (Lower) Numbers Only note (xxx) See dwg. 7103050655</b>						

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	SXRHE-VS(xxx) N	N/A	076			OK	23/08/2024 bgr
	SXRHE-HS(xxx) ↑	N/A	050			OK	23/08/2024 bgr
	SXRHE-VL(xxx) S	N/A	017			OK	23/08/2024 bgr
	SXRHE-HL(xxx) ↓	N/A	020			OK	23/08/2024 bgr
	SXRHE-VL(xxx) N	N/A	058			OK	23/08/2024 bgr
	SXRHE-HS(xxx) ↑	N/A	038			OK	23/08/2024 bgr
	SXRHE-VS(xxx) S	N/A	061			OK	23/08/2024 bgr
<b>7</b>	<b>Mechanical test: Without magnets</b>						

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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	19/06/2024 MMOL
	Z=-35, X=0 at 121mm gap	2138-D	121.04	121mm ±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=-35, X=31 at 121mm gap	2138-D	121.03	121mm ±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=35, X=-59 at 121mm gap	2138-D	121.05	121mm ±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=35, X=0 at 121mm gap	2138-D	121.04	121mm ±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	Z=35, X=31 at 121mm gap	2138-D	121.03	121mm ±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Deviation max-min at 121mm:	Calculated	0.02	<0,1 mm		OK	19/06/2024 MMOL
	Z=-35, X=-59 at 161mm gap	2138-D	161.06	161mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=-35, X=0 at 161mm gap	2138-D	161.06	161mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=-35, X=31 at 161mm gap	2138-D	161.06	161mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=35, X=-59 at 161mm gap	2138-D	161.07	161mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=35, X=0 at 161mm gap	2138-D	161.06	161mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=35, X=31 at 161mm gap	2138-D	161.06	161mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Deviation max-min at 161mm:	Calculated	0.01	<0,1 mm		OK	19/06/2024 MMOL
	Z=-35, X=-59 at 211mm gap	2138-D	211.02	211mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=-35, X=0 at 211mm gap	2138-D	211.02	211mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	Z=-35, X=31 at 211mm gap	2138-D	211.01	211mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=35, X=-59 at 211mm gap	2138-D	211.01	211mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=35, X=0 at 211mm gap	2138-D	211.01	211mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Z=35, X=31 at 211mm gap	2138-D	211.00	211mm±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Deviation max-min at 211mm:	Calculated	0.02	<0,1 mm		OK	19/06/2024 MMOL
<b>9</b>	<b>Measure the distance between the lower girder and top of base plate. Illustration can be found in "504313_ReferenceDoc"</b>						
	Gap set to 121mm	2138-D	121.00	121mm ±0,1mm	Gauge Blocks	OK	19/06/2024 MMOL
	Position of lower girder	2138-D	162.5	162,5±1	Gauge Blocks	OK	19/06/2024 MMOL
<b>10</b>	<b>Mechanical test: With magnets</b>						

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
<b>11</b>	<b>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.</b>						
	10mm ceramic block pulled through gap	2138-D	OK		Gauge Blocks	OK	18/07/2024 csoj
	Set offset parameters in motor and encoder software.	N/A	20.03635	Encoder raw Value		OK	18/07/2024 csoj
<b>12</b>	<b>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.</b>						
	100,00mm ceramic block pulled through gap	2138-D	OK		Gauge Blocks	OK	18/07/2024 csoj

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
13	<b>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.</b>						
	Initial dial setting	2138-D	15	15mm ±0,005mm	Gauge Blocks	OK	18/07/2024 csoj
	Measurement 1	2291-D	15.001	15mm ±0,007mm	Dial Indicator	OK	18/07/2024 csoj
	Measurement 2	2291-D	15.001	15mm ±0,007mm	Dial Indicator	OK	18/07/2024 csoj
	Measurement 3	2291-D	15.002	15mm ±0,007mm	Dial Indicator	OK	18/07/2024 csoj
	Max deviation	Calculated	0.002	<0,002mm		OK	18/07/2024 csoj

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
<b>14</b>	<b>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.</b>						
	Initial dial setting	2138-D	10	10mm ±0,005mm	Gauge Blocks	OK	18/07/2024 csoj
	Measurement 1	2291-D	9.999	10mm ±0,007mm	Dial Indicator	OK	18/07/2024 csoj
	Measurement 2	2291-D	9.998	10mm ±0,007mm	Dial Indicator	OK	18/07/2024 csoj
	Measurement 3	2291-D	9.998	10mm ±0,007mm	Dial Indicator	OK	18/07/2024 csoj
	Max deviation	Calculated	0.002	<0,002mm		OK	18/07/2024 csoj
<b>15</b>	<b>Mechanical test: Stop and switch settings</b>						

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
<b>16</b>	<b>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.</b>						
	Hard stop setting closed gap Set the gap to $9.84 \pm 0.04$ mm and adjust the Hard stop to reach the upper girder	N/A	OK			OK	18/07/2024 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	N/A	OK			OK	18/07/2024 csoj
<b>17</b>	<b>Limit switch setting (encoder read gap where the switch activates) Motor speed 5mm/s Approach closed gap from gap position = 20mm</b>						
	The gap "in" limit switch	2138-D	9.97	9,97mm $\pm 0,025$ mm	Gauge Blocks	OK	18/07/2024 csoj
	Encoder	N/A	19.978	Encoder raw value		OK	18/07/2024 csoj

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	The gap "in" power switch	2138-D	9.925	9,915mm ±0,03mm	Gauge Blocks	OK	18/07/2024 csoj
	Encoder	N/A	19.9185	Encoder raw value		OK	18/07/2024 csoj
<b>18</b>	<b>Limit switch setting (encoder read gap where the switch activates) Motor speed 5mm/s Approach open gap from gap position = 90mm</b>						
	The "out" limit switch	2138-D	100.45	100,5mm ±0,5mm	Gauge Blocks	OK	18/07/2024 csoj
	Encoder	N/A	110.3810	Encoder raw value		OK	18/07/2024 csoj
	The "out" power switch	2138-D	101.8	101,6mm ±0,5mm	Gauge Blocks	OK	18/07/2024 csoj
	Encoder	N/A	101.799	Encoder raw value		OK	18/07/2024 csoj

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	<b>Brake test</b> <b>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.</b>						
<b>19</b>							
	Gap initial setting	2138-D	10.54	10,5mm ±0,05mm	Gauge Blocks	OK	18/07/2024 csoj
	Encoder	N/A	20.7212	Encoder raw value		OK	18/07/2024 csoj
	Gap after power off	2291-D	10.41	10,5mm ±0,1mm	Dial Indicator	OK	18/07/2024 csoj
	Encoder	N/A	20.4630	Encoder raw value		OK	18/07/2024 csoj
	Deviation of initial setting and after power off	Calculated	0.13	0mm ±0,05mm	See NCR 4009	Not OK	18/07/2024 csoj
	<b>Open/close speed test.</b> <b>Measured in seconds</b>						
<b>20</b>	<b>First article only!</b>						
	Open to closed (40mm gap to 10mm gap)	N/A	6.5	<10s		OK	18/07/2024 csoj

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	Closed to open (10mm gap to 40mm gap)	N/A	6.6	<10s		OK	18/07/2024 csoj
<b>21</b>	<b>Magnetic test See drawing 7103050653 for magnetic center</b>						
<b>22</b>	<b>Stretch wire measurement:</b>						
	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" • 10 mm gap • 15 mm gap • 20 mm gap • 30 mm gap • 100,0 mm gap	N/A	OK	Stretchwire measurement completed		OK	30/07/2024 PMHA
<b>23</b>	<b>Hall probe measurements:</b>						

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To be carried out after assembly							
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"> <li>• 10 mm gap</li> <li>• 15 mm gap</li> <li>• 20 mm gap</li> <li>• 30 mm gap</li> <li>• 100,0 mm gap</li> </ul>	N/A	OK	Hall probe gap measurement completed		OK	30/07/2024 PMHA

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	<p>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"</p> <ul style="list-style-type: none"> <li>• 10 mm gap (x=-2)</li> <li>• 10 mm gap (x=-1)</li> <li>• 10 mm gap (x=1)</li> <li>• 10 mm gap (x=2)</li> <li>• 30,0 mm gap (x=-2)</li> <li>• 30,0 mm gap (x=-1)</li> <li>• 30,0 mm gap (x=1)</li> <li>• 30,0 mm gap (x=2)</li> </ul>	N/A	OK	Hall probe Horizontal measurement completed		OK	30/07/2024 PMHA

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To be carried out after assembly							
No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	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"> <li>• 10 mm gap (y=-0,2)</li> <li>• 10 mm gap (y=-0,1)</li> <li>• 10 mm gap (y=0)</li> <li>• 10 mm gap (y=0,1)</li> <li>• 10 mm gap (y=0,2)</li> </ul>	N/A	OK	Hall probe Vertical measurement completed		OK	23/08/2024 CSOJ
<b>24</b>	<b>Fiducial holes measurements, magnetic gap 10 mm</b>						

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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 0085	OK	26/08/2024 CSOJ
<b>25</b>	<b>Visual inspection See drawing 7103050653</b>						
	Visual appearance	N/A	OK			OK	23/08/2024 bgr
	Labels attached as indicated by drawing	N/A	OK			OK	23/08/2024 bgr
	Varnistop applied to bolts.	N/A	OK			OK	23/08/2024 bgr
<b>26</b>	<b>Corrosion protection, all surfaces</b>						
	Protection product used:	N/A	OK	All bare metal protected	Product used:	OK	23/08/2024 bgr

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No.	Description	Test equipment	Result	Criteria / Tolerance	Comments	Accepted	Sign/Date
	Data label	N/A	OK	Label present		OK	23/08/2024 bgr
<b>27</b>	<b>Production control</b>						
	Approved by	N/A	OK			OK	23/08/2024 bgr
<b>28</b>	<b>Lead Engineer</b>						
	Approved by	N/A	OK			OK	23/08/2024 JPKR