

1451789

by Joshua Williams

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Presentation 1

Load Test Rig for Siemens S120 Servo Drives

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Project Background, Problem Definition and Constraints

- ▶ Current situation - a test rig for testing Siemens S120 Drives.
- ▶ Reason 1: Elements of the drive will not be proven to run at full capacity without a full load test.
- ▶ Reason 2: Equipment and Personnel Safety.



FDS (Functional Design Specification)

The FDS has been constructed and agreed with the following categories:

- ▶ A - Function of Machine
- ▶ B - Safety Features
- ▶ C - Display Data Operation
- ▶ D - Alarm Messages
- ▶ E - Performance Requirements

FDS – Function of the Machine & Safety Features

A1.1	The loading device must load a motor up to a required load.
A1.2	At different speeds the loading device must adapt withstand the change of speed specification.
A1.3	The load testing system must work in conjunction with the Siemens Sinamics Test rig.
B1.1	The system must have the correct enclosed guarding for moving parts in accordance with the Machine Directive EN60204.
B1.2	Machine must have the correct interlocking device(s) in accordance with ISO 14119.
B1.3	The machine must have safe isolation of the test rig and loading system.
B1.4	Any fault condition will be displayed on the local control panel (beacon or pilot light flashing 0.5Hz).
B1.5	Prevention in place to stop overheating and overload of the loading system.

FDS – Display Data Operation & Performance Requirements

D1.1	A display message showing that all safety device contacts are closed.
D1.2	Upon selection of any engagement of moving components, a second display will appear with a message to make sure the intended operation is correct.
D1.3	A display to inform operator of any faults with any part of the communication system.
E1.2	The loading system should have required amount of torque that is suitable for the motor that is connected to the drive. The testing range should be: 5.0Nm – 18Nm
E1.3	The loading system should be able to achieve the speed testing range of 500rpm – 3000rpm.
E1.4	The loading system should be required to test the following current range: 5.0A – 18A (motor rating values).
E1.5	The loading system will be capable of testing the power range of 2.1kW to 8.2kW.

Project Risks and Health & Safety

- ▶ Changes with deadlines on other projects.
- ▶ Material Availability.
- ▶ Requirement changes to the system.

Machinery Safety Directive 98/37/EC, modified to 98/79/EC and all its amendments.
Electromagnetic Compatibility Directive 2004/108/EC and all its amendments.
Low Voltage Directive 2006/95/EC and all its amendments.
EN61000-6-1, 2019.
EN60204-1; 2018, EN55022 class B; 1998, DIN VDE 0839 part 81-1, EN55014-1, 2006, EN55011, 2004.
We also confirm that the aforementioned equipment is fully in compliance with mandatory EU regulations.

Test Planning

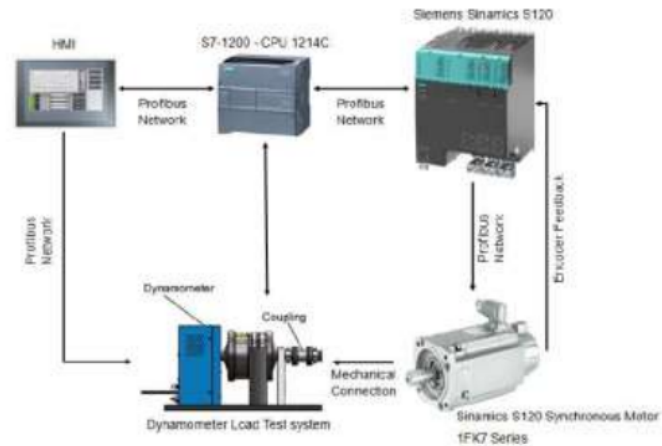
Section	Test Number	Reference	Test Description	Expected Result	Actual Outcome	Pass/Fail	Evidence
A. Function of the machine.							
	1	A1.1	Verify the loading device can load a motor up to the required load.	Meets the required load specification. The range of 5.0Nm – 18Nm.			
	2	A1.2	Ensure the loading system adapts to different speeds during the test.	The loading system adapts to the speed changes.			
	3	A1.3	Ensure the loading system adapts to different speeds during the test.	Confirmed communication and the machine works cohesively.			

B. Safety Features.				
	4	B1.1	Verify enclosed guarding for moving parts.	Guarding effectively protects moving parts.
	5	B1.2	Ensure the system has the correct interlocking	Interlocking devices work correctly and conform with the

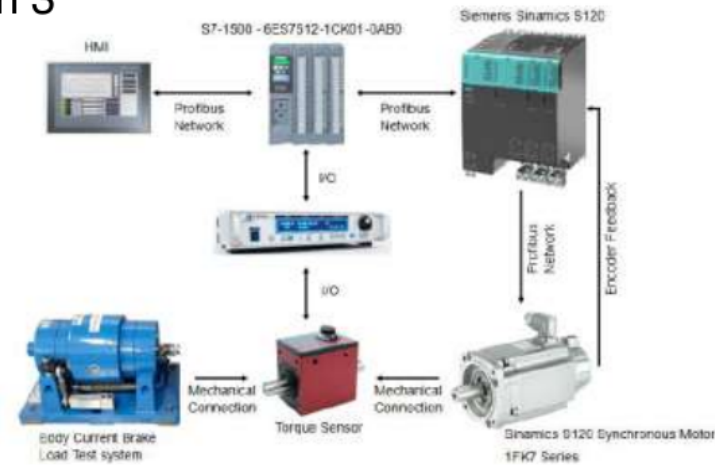
18	E1.3	The loading system should be able to achieve the speed testing range of 500rpm – 3000rpm.	The loading system confirms the required range of RPM.
19	E1.4	The current range of 5.0A – 18A (motor rating values) can be achieved.	The system can safely load to the following current range.
20	E1.5	The power range of 2.1kW to 8.2kW can be tested.	The loading system can handle the power range.

Three Solutions - Overview

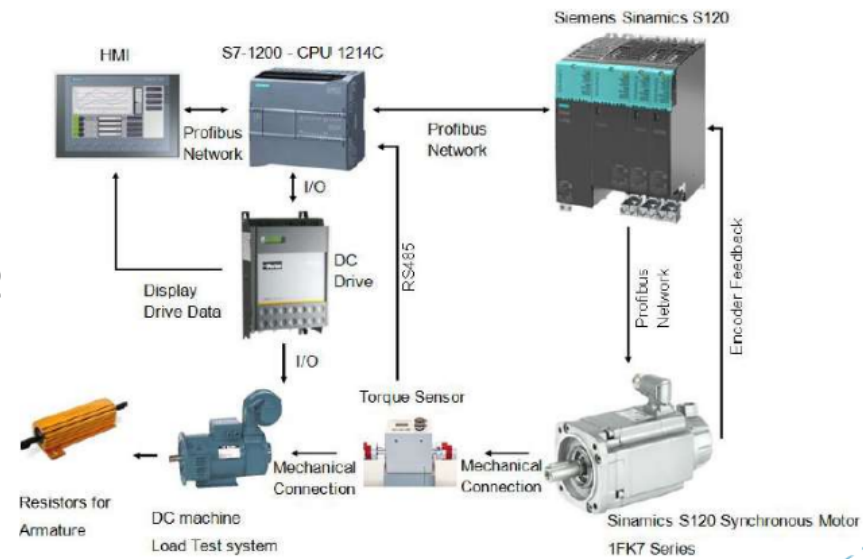
Solution 1



Solution 3



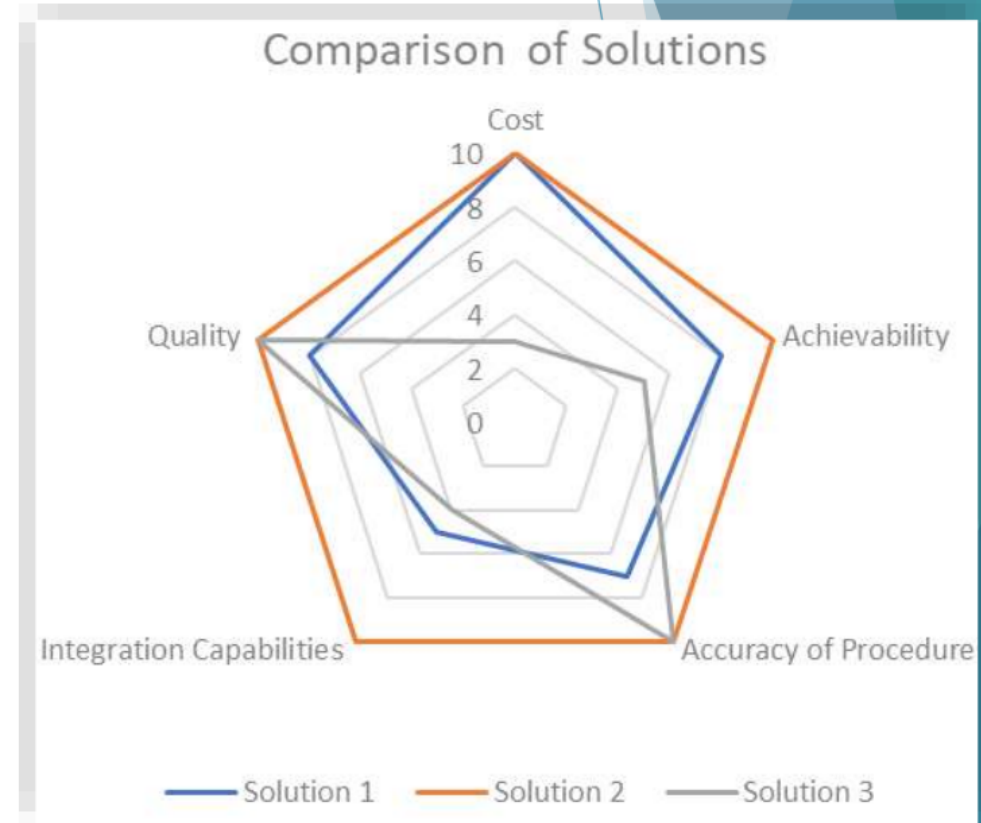
Solution 2



Three Solution Comparison

Target	Solution 1	Solution 2	Solution 3
Cost	10	10	3
Achievability	8	10	5
Accuracy of Procedure	7	10	10
Integration Capabilities	5	10	4
Quality	8	10	10

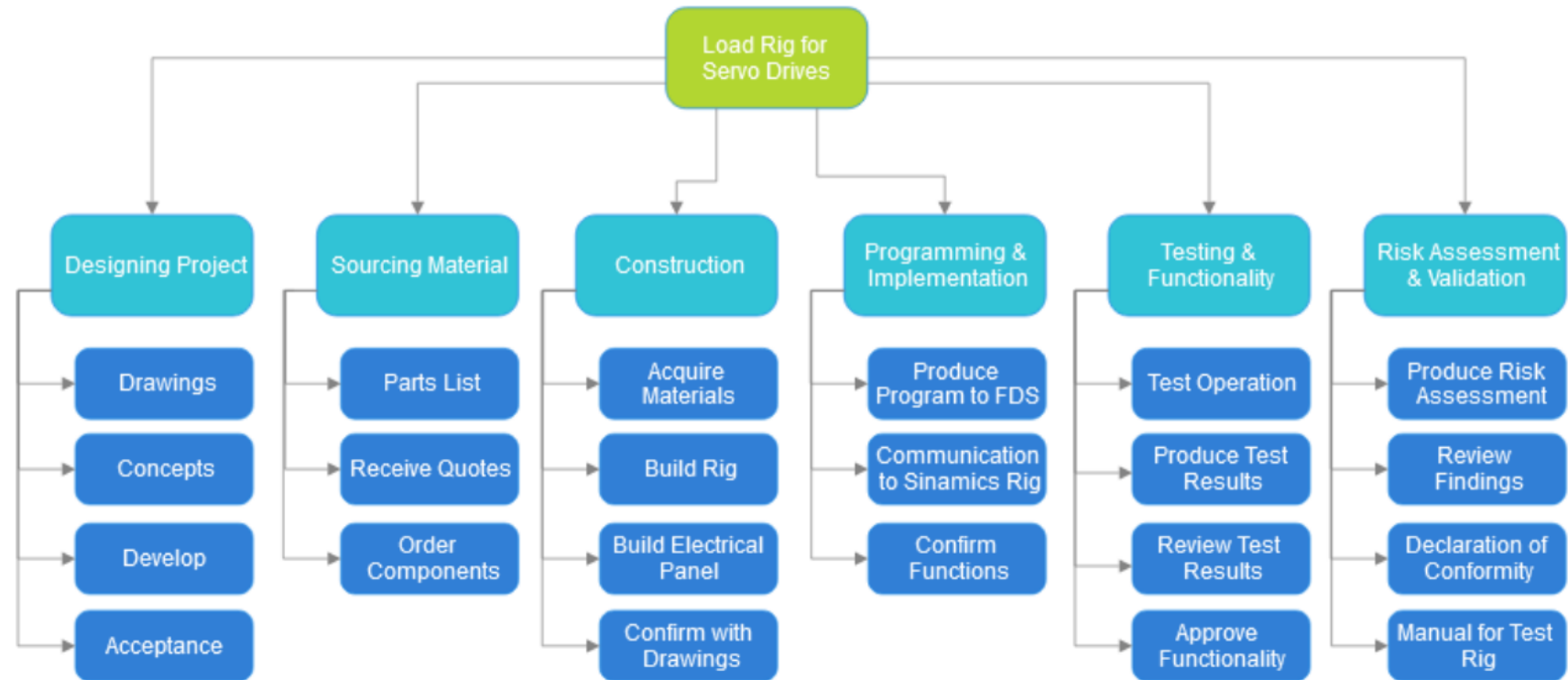
Solution	Cost
1	£9800
2	£9500
3	£16600



Justification on Final Solution

	Advantages	Disadvantages
Solution 1	• Simple Design • Within Budget • Accuracy of results • Size of system	• Integration Difficulties • Insufficient guidelines on installing the dynamometer
Solution 2	• Ease of integration into the siemens S7-1200 • Efficient calibration • Torque sensor uses RS485 communication. • DC drive has simple I/O and analogue speed reference	• Aesthetic of the overall machine • Limited capabilities
Solution 3	• Overall accuracy the best • Aesthetics are pleasing. • Size of the system	• Not within budget • Integration capabilities within the timeframe • Water cooling for brake would prove difficult to implement

Work Breakdown Structure



[illegible]

Load Test Rig for Servo Drives Project Planner



Period Highlight: 3

3

Plan Duration

Actual Start

% Complete

PERIODS

[illegible]

FINAL GRADE

GENERAL COMMENTS

71 /100

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GRADING FORM: NEW CSG-RUBRIC

JOSHUA WILLIAMS

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1. ENGAGEMENT WITH LITERATURE

 NA

2. KNOWLEDGE AND UNDERSTANDING

 Project background and problem definition (7/10)
Project constraints, risks, health and safety (7/10)
Response to questions (7/10)

21

3. COGNITIVE AND INTELLECTUAL



Functional Design Specification (8/10)
Test planning (7/10)
Project Planning and management methods (7/10)

22

4. PRACTICAL APPLICATION



Review of Solutions (6/10)
Justification of final solution (6/10)

12

5. TRANSFERABLE SKILLS



Quality of the presentation slides (8/10)
Quality of the delivery style (8/10)

16