

TECHNICAL SPECIFICATION

DESIGN, DEVELOPMENT AND MANUFACTURE OF ELECTRICAL SUB-SYSTEM FOR KAVACH MOD-II

1) Brief Description:

Kavach Mod-II System consists of Launcher, Electrical Sub-system and Fire Control System. These Chaff launcher systems are being installed on board all class of Ships viz. Aircraft Carrier, Destroyer, Corvett etc. The launchers can be positioned both in azimuth and elevation to any desired angle through the Electrical Sub-System when commanded from the Fire Control System. As all the systems of Kavach Mod-II are being installed on board the ships, various MIL Standards are to be followed in the design of the systems from component selection to fabrication.

2) Basic Functions of the Electrical Sub-System.

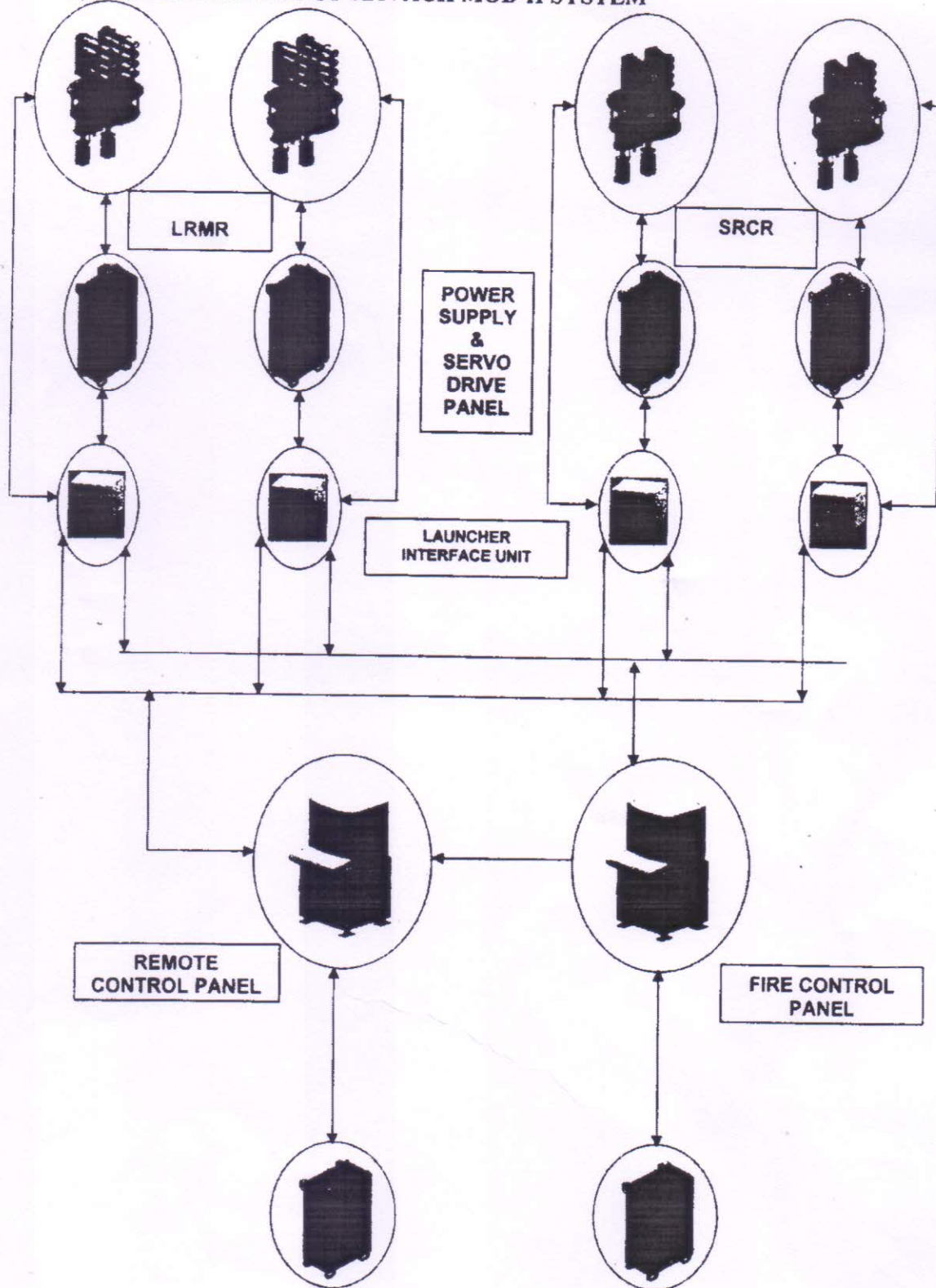
- a) To isolate and distribute the Ship Supply (380V – 415V, 3 phase, Delta) to various sub-systems of Kavach
- b) To generate regulated supply (230V, 1 Phase) for various sub-systems of Kavach through auto transformer.
- c) To provide for isolated ground terminal as the ship supply is delta and no ground is provided on board the ship.
- d) To provide for 24V DC (100 AH) back up in case of failure of ship supply.
- e) To provide control for Switching On/Off of the supplies to the various sub-systems, as all the supplies are routed through the Distribution Panel.
- f) To provide isolation between 230V supply and 24V supply, so that only either of the two are available. Both automatic change over to 24V DC when ship supply is not available and manual change over by the user is to be provided.
- g) To provide for MMI screen on the Distribution Panel which displays the 3-Phase Voltages per line, line currents, Battery status, Current Supply Used (AC/DC) and other diagnostic/BITE features.
- h) The Servo Drives and Servo Motors should be **compact, miniature** capable of rotating the launchers at a speed of 60 degree per second when commanded from the fire control system through Ethernet interface.
- i) All fault diagnostics/bite should be performed by the system on Power ON and be relayed to the Fire Control System on query.
- j) The health/faults of the servo drives is to be provided on an MMI screen on the servo panel.
- k) The Servo motors should be able to be controlled from both the Fire control System and locally through the MMI screen.

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3) BLOCK DIAGRAM OF KAVACH MOD-II SYSTEM



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The following can be inferred from the block diagram of Kavach Mod-II.

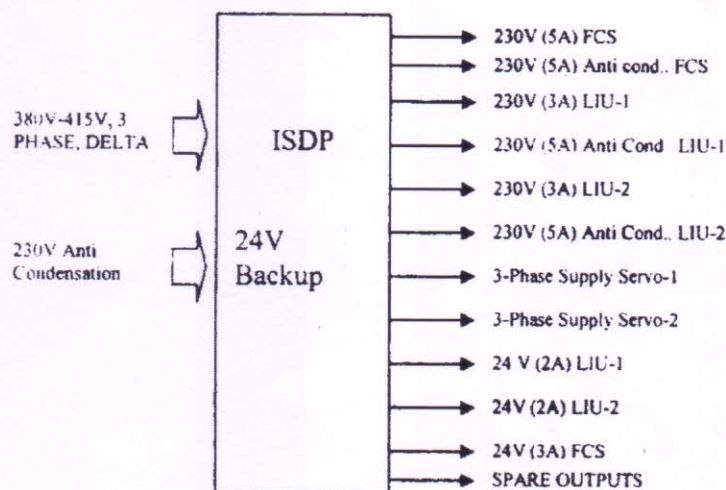
- The ship supply (3phase, 380 – 415V) is distributed to various sub-systems through the Isolation Switch Distribution Panel (ISDP).
- One ISDP serves a set of two launchers. As the Kavach Mod-II System has four number of launchers, two numbers of ISDP is required.
- One number of Servo Panel which houses the Servo Drives is required per launcher. As the launchers have to be rotated in both azimuth and elevation simultaneously two numbers of servo Drives (one azimuth and one elevation) housed in a single Panel are required. Total number of Servo Panels for Kavach Mod-II System is four.
- As the launcher can be rotated in azimuth and elevation simultaneously two numbers of servo motors driven independently by two servo drives is required. Total number of motors for Kavach Mod-II System is eight.

4) Technical Specifications of Electrical Sub-System

The Electrical Sub-System can be divided into three sub-assemblies.

- Isolation Switch Distribution Panel (ISDP)
- Servo Panel
- Servo Motors

a) Isolation Switch Distribution Panel



- Very good isolation to be provided from the fluctuations of the ship supply.
- 3 Phase supply to be converted to 230V single phase supply with good voltage regulation using auto transformer for distribution.
- 24V backup (min 100AH) to be catered, so that automatic change over to 24V takes place when ship supply is not available and manual change over can be performed.
- Independent control i.e Switch ON/OFF to be made available on the ISDP, i.e

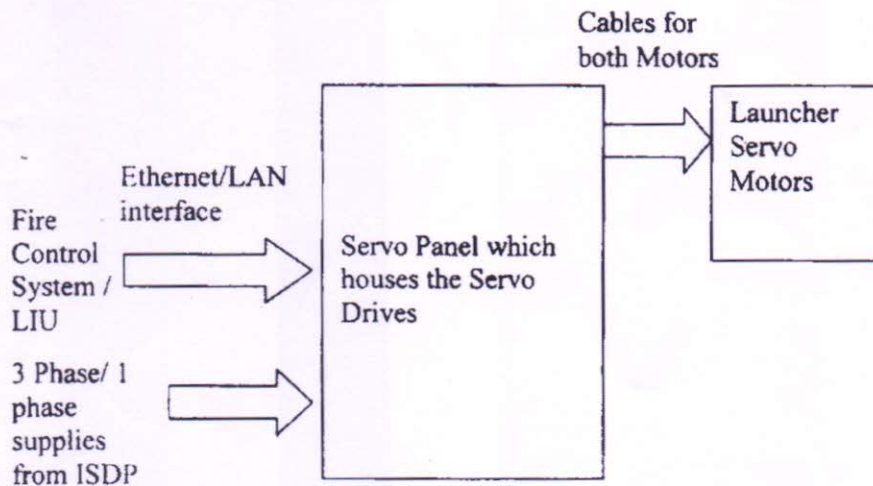
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- a) Input 3 Phase supply switch
- b) Output (FCS 230V) switch
- c) Output (LIU-1 230V and LIU-2 230V) combined switch
- d) Output (Servo-1) switch
- e) Output (Servo-2) switch
- f) Output switch for all 24V combined
- g) Output switch for all 230V anti cond.. combined
- o Control Circuit to make sure that both 230V AC and 24V DC are not output simultaneously
- o Any other supplies as needed for the Servo drives need to be tapped from the Distribution Panel.
- o MMI screen for all BITE/fault diagnostic features, 3 phase voltages, line currents etc.
- o All components are to be of MIL grade and circular connectors for input and output.

b) Servo Panel:



- o The Servo Panel houses the necessary Servo drives both driving both the motors simultaneously.
- o The Servo Panel is interfaced to the Fire control System/LIU through **Ethernet interface**.
- o The Fire Control System/LIU would command the Servo drive to Start/Stop the Servo Motors.
- o MMI Screen should be provided on the Servo Panel which provides for BITE. Fault diagnostics, stand alone rotation of both the servo motors etc.
- o All the BITE/diagnostic/health features of the drives are to be communicated to the Fire Control Sytem/LIU on query basis.
- o The Servo Panel, Servo Drives have to be **compact, robust and minature** capable of driving the Servo Motors.

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- The Servo Drives should be capable of rotating the launcher at a minimum speed of 60 degree per second.
- The Servo Drives should be suitably of Seimens make, the part number may be suitably selected based on the specifications of the servo motor.

c) Servo Motor:

- The Servo Motors should be **compact, miniature and robust.**
- Minimum RPM: 2000
- Maximum continuous torque: 40 Nm
- Encoder based servo motor instead of tacho based motors.
- The shaft diameter to be communicated to MPF during design.

5) System Qualification Requirements:

- As the systems are installed on board the Ships, the panels are to be sea worthy.
- The System will be subjected to Environmental tests as per JSS 55555 2012 rev 3. (Appendix - 'A')
- The System will be subjected to Environmental Stress Screening (ESS) as per DQAN guidelines dated 14 Jun 2013. (Appendix - 'B')
- The Electromagnetic Interference/Electromagnetic Compatibility (EMI/EMC) tests would be as per MIL-STD 461 E. (Appendix - 'C')

6) System Acceptance Criteria.

- As the System is to be installed on board the ship, the acceptance criteria are defined by Directorate General of Quality Assurance Navy (DQAN).

a) First R&D System

- A scaled down version of the final ESS System viz. ISDP: 1 No
Servo Drive: 2 Nos
to be developed for all system qualification tests.
- The Bill of Material, drawings, Acceptance Test Procedure Quality Assurance Plan (QAP) to be forwarded to MPF for Scrutiny and final approval by DQAN.
- The system would be subjected to all the System qualification Tests as stated above (S.no 5).
- This System after integration with the launcher and FATs would undergo firing trials before final acceptance
- This System would be Yellow Banded and all the bill of material sealed.

b) Follow in Systems:

- Once the R&D System has been Yellow Banded and BPC would be accorded for Bulk Production

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- These Systems would be subjected to ATP and Environmental Stress Screening (ESS) as per DQAN guidelines dated 14 Jun 2013. (Appendix -'B') only.
- **Factory Acceptance Test:** The System would be integrated with other Sub-assemblies and tests performed at MPF.
- **Harbor Acceptance Test:** The System after FATs would be installed on board the ships. After integration of the system tests would be performed on board the ship.
- **Sea Acceptance Test:** This is the final acceptance test which would be performed in deep sea.

7) General Terms and Conditions:

- a) The Systems installed on board the ships require after sales support for a minimum of 20 years. Design should be robust enough and components to be selected to take care of obsolescence.
- b) Design should be flexible enough that in case of any obsolescence number of changes should suffice for the system to be operational.
- c) Adequate number of Spares are to be provided along with the system
- d) Shock mounts, vibration mounts to be taken care in the design as the systems are installed on board unstable platforms.
- e) Vendors needs to provide technical support for each system until Completion of SATs.

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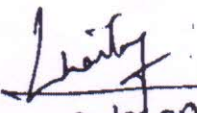
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Appendix-A

S.no	Test	Specification	Test condition	Remarks
a	High Temp	JSS 55555- Test 17	55±3 Degree C for 16 hours Procedure 5 Test condition G	
b	Damp Heat	JSS 55555- Test 10	40 ±2 Degree C at 95 RH for 16 hours	
c	Drip Proof	JSS 55555- Test 11	Vertical Water droplet 1 meter height for 15 minutes	
d	Mould growth	JSS 55555- Test 21	29 Degree C, 90% RH mould growth chamber for 28 days	On test coupons only
E	Bump	JSS 55555- Test 5	4000±10 bumps, 40g, 6msec, 1 to 3 bumps/sec	
F	Shock/Impact	JSS 55555- Test 24	As per laid down specifications	
G	Low Temp	JSS 55555- Test 20	0 Degree for 16 hours as per procedure 4	
H	Tropical Exposure	JSS 55555- Test 27	As per laid down specifications	
I	Vibration test	JSS 55555- Test 28 (Conducted for 5 to 33Hz)	As per laid down specifications	Equipments on shock mounts as in use

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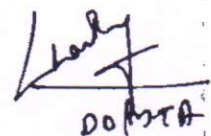

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Appendix-B

S.no	Test		Authority
A	Thermal Shock	-40 Degree C/0 Degree C (For commercial Grade components)-90 min 70 Degree C-90 Min Change over to take place within 5 min No of cycles-06	100% on all PCB
	Thermal Cycling	OR -30 to 55 Degree C Change at 1 Degree C/Min, 3 Cycle dwell Upto 20 Kg – 2 hrs 20 – 40 Kg – 3 hrs Above 40 Kg – 4 hrs	Sub unit / Equipment with power on
B	Vibration Test	Random Vibration freq 20-2000Hz power density 02g2 Hz 10 min Each in three axis	Fully wired card cages, Power amplifiers, power supplies, modules, subassemblies.
		OR i. Sinusoidal vibration 10-150 Hz sweep 2g/ 5 min in each of the three mutually perpendicular direction ii. 300 Bump 40g, 6 millisecond in one axis only	-do-
C	Burn-in	168 Hrs at room temperature under maximum load OR 48 hrs at full load at 55 Degree C	Complete system set

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Appendix-C

S.no	Test	Specification
A	Conducted Emission	CE 01
B	Conducted Emission	CE 03
C	Conducted Susceptibility	CS 01
D	Conducted Susceptibility	CS 02
E	Conducted Susceptibility	CS 06
F	Radiated Emission	RE 01
G	Radiated Emission	RE 02
H	Radiated Susceptibility	RS 01
I	Radiated Susceptibility	RS 02
J	Radiated Susceptibility	RS 03

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