

SAFETY INSTRUCTIONS FOR LEAR INJECTION AND EJECTION KICKERS

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1. INTRODUCTION

The LEAR kicker system provides the fast, beam deflection necessary for injection and ejection to and from the LEAR ring.

Section 4 to 6 of these instructions concern isolation of the kicker system from all primary 3 phase supplies. Isolation at this level removes risk of high voltage and low voltage contact and permits access to the equipment to all categories of personnel.

Section 7 defines the procedures necessary to remove risk of high voltage contact when carrying out repair work on certain parts of the system with other parts still energized.

2. DESCRIPTION OF THE LEAR KICKER SYSTEM

A simplified block schematic is shown in Figure 1. The system comprises high and low voltage equipment in the LEAR ring area and low voltage equipment in the LEAR Equipment Room.

Figure 2 shows the physical location of the system components which are relevant to their safety instructions. The primary three-phase supply to the system is obtained from Armoire No. 6-9-2-30. Departure No. 12, located outside the ring area. This supply is then divided into six individual 3 Ø subsystem supplies in the fused switchboard marked "LEAR KICKERS 12, 14 & 42", located on the upper kicker platform. All these subsystem supplies are

breakable and can be locked off; five of them with switch keys and one by means of a padlock. The connection and labelling of the 3 phase switched supplies is as shown in fig.3.

Modules A, R and B consist each of two high voltage switch tanks named MS (Main Switch) and DS (Dump Switch). These elements are located on the upper tier of a raised platform structure situated within the LEAR ring area. The switch tanks are connected to the extremities of large diameter SF6 gas pressurised cables. The switch tanks are supplied with low voltage from the one rack associated with each module. These racks are located on the lower tier of the platform.

Flexible high voltage cables connect the Main Switch of each module to magnets which are found on vacuum tanks situated in the ring sections 14 and 42. These magnets are supplied with high voltage (40kV) pulses from the three modules.

In the "well" under the upper tier of the platform are installed the local and maintenance oil pumping stations.

Each magnet is fitted with a high voltage changeover switch (HVCO) system to allow remotely-controlled polarity changes. Their switches are supplied with low voltage from rack 017 in the LEAR equipment room.

3. GENERAL PRINCIPLES TO BE OBSERVED FOR SAFE WORKING ON THE LEAR KICKER SYSTEM

Because of the large number of interconnections which exist between different, sometimes remote, parts of the system and the very high voltages (up to 85 kV) which are present, certain principles must be laid down in order to guarantee safe working conditions during repair, modification or maintenance. The application of these rules may result in more equipment being isolated than is strictly necessary for access to a particular system but the principles must nevertheless be rigourously respected. The principles are as follows :

- a) No work may be performed on any ring installed equipment unless all pulse generators (A, R and B), the oil system and HVCO switch system have been isolated.

- b) No work may be performed on any pulse generator (A, R and B) until the generator has been isolated from the 3 phase electrical supply.
- c) No work may be performed on the complete LEAR kicker system until isolation of the whole system has been made at the 3 phase supply switchboard.
- d) In the absence of a complete isolation of the LEAR kicker system according to c) above, individual electronic chassis, which are in some cases supplied with power from remote parts of the system, must be considered live until isolated by removal of all ingoing and outgoing cable connectors. Particular attention should be paid to the Trigger Pulse Amplifier chassis in which exist voltages of up to 3000V.
- e) The system contains a certain number of electronically operated HT and LT interlocks which are intended to prevent accidents involving personnel or damage to equipment in the event of faulty operation.

Under no circumstances are these interlocks to be relied upon to provide a safe environment for maintenance or repair work.

- f) Work which involves dismantling of either the vacuum tanks or PFN interfaces should not be commenced until any SF6 gas in these interfaces has been reduced to atmospheric pressure.

4. SAFE WORKING ON EQUIPMENT INSTALLED ON THE LEAR KICKER PLATFORM OR IN LEAR EQUIPMENT ROOM

To work safely on any or all of the LEAR platform or equipment room installed equipment of the LEAR kicker system proceed as follows :

- a) Isolate and lock in the "OFF" position the 3 phase switches marked GEN.A, GEN.R, GEN.B, ELECTRONICS and MAINT.OIL SYSTEM, isolate + padlock the 3 phase switch marked OIL SYSTEM, and personally retain all the keys.
- b) Affix a notice to the switchboard giving the name of the person holding the keys. The keys must remain in possession of the person executing the work in the ring and must only be released when the work is terminated and the equipment safe to re-energize. The person holding

the keys obtained from a) above automatically assumes responsibility for the safety of the personnel involved in the work on the platform and LEAR equipment room.

5. SAFE WORKING ON THE LEAR RING INSTALLED EQUIPMENT

To work safely on any or all of the LEAR ring installed equipment proceed as specified in section 4. The holder of the keys automatically assumes responsibility for the safety of the personnel involved in the work in the ring.

6. SIMULTANEOUS WORKING ON EQUIPMENT IN LEAR RING, LEAR KICKER PLATFORM AND LEAR EQUIPMENT ROOM

Should it be necessary for several persons to work at the same time on LEAR kicker equipment in the LEAR ring, on the LEAR kicker platform and in the LEAR equipment room the following precautions must be taken :

- a) The procedure laid down in section 5 will be carried out by the persons working on ring equipment
- b) All other persons working on the kicker platform and in LEAR equipment room will mark their names on the notice affixed to the 3 Ø switchboard by the holder of the keys so that their presence is notified.

The holder of the keys specified in section 5a) becomes responsible for the safety of all the personnel working on LEAR kicker equipment. Only when the work in the ring, LEAR kicker platform and LEAR equipment room is completed and the equipment safe to re-energize will power be reapplied to the system.

7. SAFE WORKING WITH THE SYSTEM PARTLY DE-ENERGIZED

Under certain circumstances it may be necessary that repair work be carried out on one or more generators with the other generators pulsing normally. In this case a risk of low voltage contact exists and the work must be carried out by a qualified operative in the presence of a second person as defined in the CERN Safety regulations. In order to eliminate the risk of high voltage contact and to minimize the risk of low voltage contact the following procedure must be strictly observed.

- a) Isolate the generator to be worked on at the 3 phase supply switchboard and padlock the switch in the "OFF" position. Retain the padlock key until the generator is safe to re-energize.
- b) Verify by inspection of the supply racks pertaining to the generator to be worked on that the primary capacitors are discharged.
- c) Temporarily stop all other modules from pulsing by isolating their "Sorenson" power supplies, discharging the capacitor banks, and setting the "LOCAL HT SWITCH" on the interlock unit to "OFF".
- d) Locate the two flexible coaxial high voltage cables connected to the outputs of the MS of the modules to be worked on. At their remote end, connect these cables into the earthed brass caps provided. Work on the module or modules thus de-energized may now proceed, and the modules concerned in c) allowed to pulse.

Work on the generator thus de-energized may now proceed. If during repair work any parts normally at high tension become exposed these should be earthed, first with the earthing rod provided and then with permanent earth leads. The earth side of these leads should always be connected before the other end is attached to the component to be made safe.

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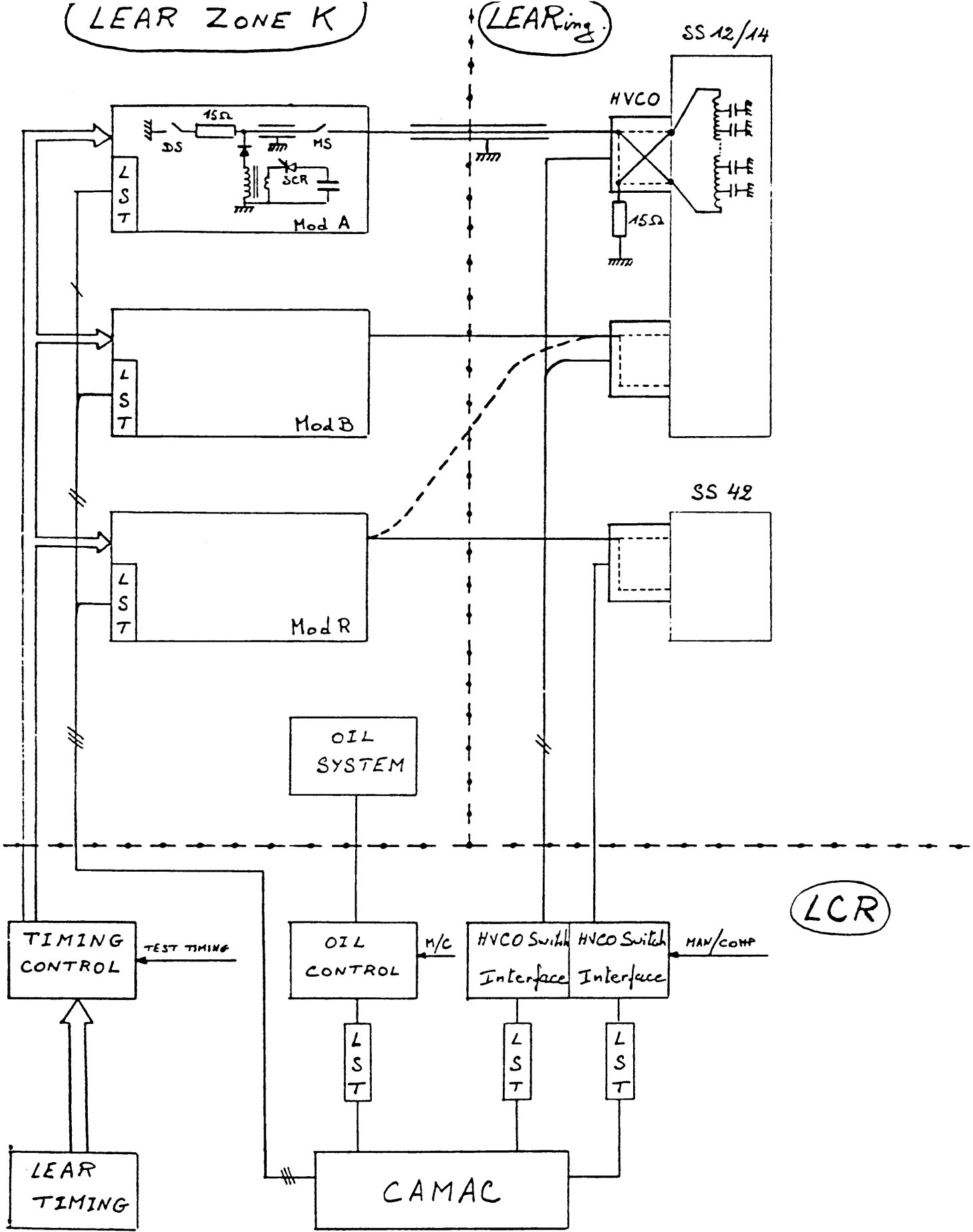


Fig. 1

BLOCK-DIAGRAM
OF LEAR KICKERS

