ENTRON

APPLICATION NOTE 700174B

EN1000/EN1001 MULTIPLE LOAD DISTRIBUTION CONTROL (LDC)

Load Distribution Control – A load distribution control (LDC) is a device intended for use with resistance welding machines having two or more welding transformers. The control is arranged to distribute the load by energizing the welding transformers in sequence on one or more phases or simultaneously on two or more phases.

To aid in understanding and discussing load distribution, refer to Drawing 440270 (Revision A or later) which is included on last page of this Application Note.

Most commonly, LDC or Load Distribution Control is defined as a three phase control. Actually, this type of LDC is three individual single phase controls, each connected across one phase of a three phase line. The control has provisions for initiating the control in a simultaneous or cascade mode. In the simultaneous mode, all three phases are initiated simultaneously, 120 electrical degrees apart as they are generated by the power company.

All alternating current generators are rotating devices and, like any rotating device, will pass through 360 degrees of rotation for each complete turn of the rotor. The voltage so derived is a sine wave. Starting from zero the curve generated will reach a peak at 90 degrees of rotation, return to zero in the next 90 degrees (at 180 degrees of rotation), reach the alternate peak in another 90 degrees (at 270 degrees of rotation) and again return to zero in the next 90 degrees (360 degrees of rotation). The three phases of power generation are separated by 120 degrees as they pass through zero (or any other point on the sine wave). Simply, 360/3 = 120.

In any plant, single phase electrical equipment, including resistance welding transformers, are usually installed, individually, across any phase without regard to load balance. A three phase LDC resistance welding control, with balanced transformer loads on each phase and with like secondary conditions will present a balanced load to the power company when the control is initiated.

Thus the customer is, essentially, promised a balanced load when using a three phase LDC control. When the control is operated in the cascade mode, the transformer(s) on each phase is caused to conduct, sequentially, one immediately after the other, across the three phases, thereby balancing the load equally, phase-for-phase. No power savings accrue specifically, although savings do occur since the peak demand will be less than firing the same total KVA on a single phase line.

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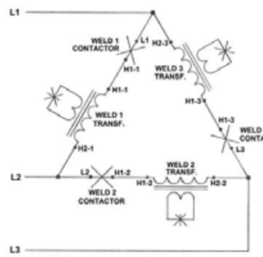
Operating in the simultaneous mode will provide both energy and time savings. In the simultaneous mode, all three transformers will be conducting (after the first 240 electrical degrees) so that any one transformer will be supplying the energization current for the others, reducing the primary current requirements of the transformer by about 16-2/3% over a single phase operation. In addition, if all weld counts are the same, the actual weld time will be only 2/3 of a cycle longer than the weld count of one transformer, not 3 times as long.

Independent count and current adjustments are provided on ENTRON LDC controls since most machine manufacturers do not electrically balance the secondaries on their LDC machines. By independently being able to adjust count and current per phase, proper balance can often be attained.

With energy costs as high as they are today, it may be to advantageous to use a three phase LDC control in place of a single phase cascade control. Even when two, four or five transformers are used, the LDC will be better able to balance the load than using a multiple transformer, single phase control. Multiples of three transformers are, of course, the most efficient.

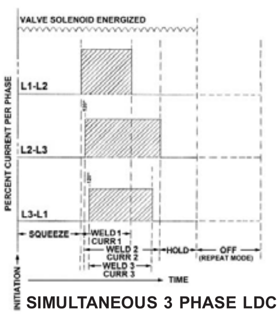
THREE PHASE LOAD DISTRIBUTION CONTROLS

WELD POWER CONNECTIONS

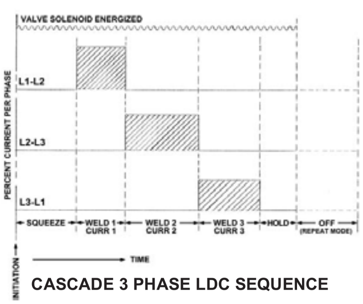


THREE PHASE LDC WIRING
Load Distribution Control

TIME/CURRENT DIAGRAMS



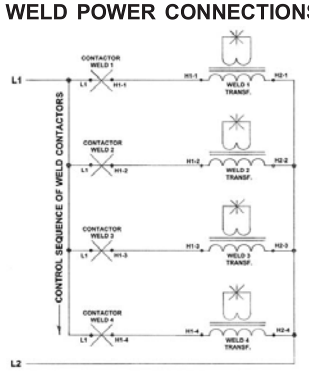
SIMULTANEOUS 3 PHASE LDC SEQUENCE



CASCADE 3 PHASE LDC SEQUENCE

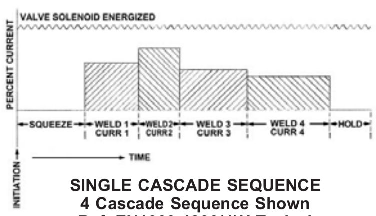
SINGLE PHASE CASCADE CONTROLS

WELD POWER CONNECTIONS



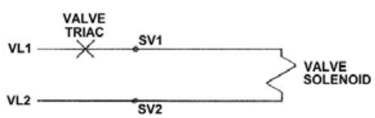
EN1000 CASCADE
Multi-Transformer Control

TIME/CURRENT DIAGRAMS



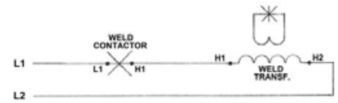
SINGLE CASCADE SEQUENCE
4 Cascade Sequence Shown
Ref: EN1000-1200(4)H Typical

WELD SOLENOID VALVE CONNECTIONS



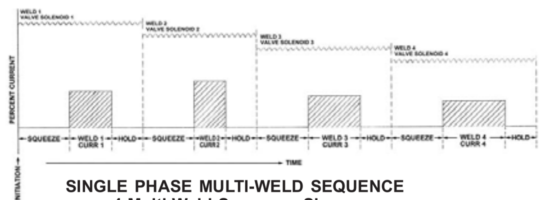
SINGLE PHASE MULTI-WELD CONTROLS

WELD POWER CONNECTIONS



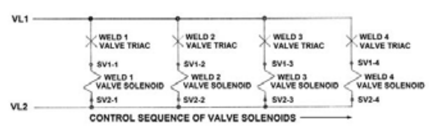
EN1000 SERIES
Single Contactor Control

TIME/CURRENT DIAGRAMS



SINGLE PHASE MULTI-WELD SEQUENCE
4 Multi-Weld Sequence Shown
Ref: EN1000(4)-1200L Typical

WELD SOLENOID VALVE CONNECTIONS



REV	AUTH	DESCRIPTION	DRAWN BY DATE	CHKD BY DATE
A	DCS 4/16/13	ADDED DRAWINGS 440271 & 440272 TO THIS DRAWING. REMOVED CONTROL SERIES INFO.	DCS 4/16/13	
—	—	ORIGINAL RELEASE		

460064

ENTRON

SCALE	DATE	DRAWN BY	CHK'D BY	APPROVED BY
NONE	7/13/82	RGC		

TOLERANCE UNLESS SPECIFIED
ANGLES: ± 1/2°
DECIMALS: ± .010
FRACTIONS ± 1/64

REVISED: REV LTR A, APPROVED BY DCS, DATE 4/16/13

TIME/CURRENT DIAGRAMS – SINGLE PHASE AND THREE PHASE

NEXT ASSM/USED ON | DRAWING NUMBER 440270 | REV A

DRAWING NUMBER 440270 – __ REV A

ENTRON 470048 11 x 17