

DATE: FEB. 19, 1999



TECHNICAL BULLETIN 99T-3

AUTHOR: PAUL TOLLAR

NEW CARLYLE MOTOR PROTECTION OPTIONS

Carlyle is announcing new motor protection options for our semi-hermetic 06E, 06CC and 06T screw compressors. These will be our primary overcurrent protection.

Carlyle is approving the Furnas "958" series solid state overload relays for our compressors. These devices have been successfully used to protect other Carlyle compressor models and will meet our entire running and locked rotor protection requirements. In addition, it offers a number of features. It is a manual reset device that allows adjustable control over a wide range. Only six different relays are required to protect our entire line of 15 to 50 hp semi-hermetic compressor models in all voltages. This is a heater-less design that operates well over a wide ambient range. It is a self-powered overload that is very simple to wire. Attached is Furnas catalog information covering the "958" series overload relay.

If customers wish to source this device directly from Furnas, it is important that they select the Furnas models per the selections shown in Charts A to F. No deviations from these selections are allowed without approval of the Carlyle Application Engineering Department. The 4th digit of the Furnas relay varies the amp range. The 8th digit indicates the trip curve and Carlyle recommends the "B". The "A" trip curve may be too quick and cause nuisance trips.

Carlyle requires the "95" and "96" pilot duty relay contacts be wired into the unit's control circuit and de-energize the compressor's contactor when an overcurrent condition opens the relay. The relay has a reset button that must be pressed to reset the relay and allow the

compressor to continue to operate. In addition, the relay is supplied with a factory must hold setting in low range. The OEM should adjust the relay to the desired must hold setting. The must trip setting is 112% of this value. The must trip setting for any compressor must be less than the "MAX MUST TRIP AMPS" shown in the compressor motor data section of Charts A to F. To set the must hold setting, the dial setting on the relay can be used. It has been factory calibrated for proper current settings. If the must hold setting is between two values on the dial, there are audible clicks which allow fine-tuning. The number of clicks varies between different portions of the dial and different relays and should be individually checked. After the must hold setting has been made, Carlyle requires the adjustable setting of the relay to be incapacitated. This is to allow the use of the must trip setting as the Maximum Continuous Current (MCC) value of the compressor. Carlyle requires the application of RTV material on the adjustment dial of the relay to make field modifications impossible. A small cover plate is supplied in the relay carton and should be mounted above the adjustment dial. A printed label is also with this cover plate which will allow the OEM to mark the must hold setting of the device. The RLA value shown in the attached Charts A to F is based on the RLA being 140% of the maximum continuous current (MCC) of the compressor.

Carlyle Compressor Div.

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One limitation of this Furnas overload relay is it will not properly protect a compressor applied with an inverter. Carlyle will approve the use of the overcurrent protection provided by most inverter manufacturers. The OEM is responsible for ensuring the inverter is programmed to meet the running and locked rotor ampere requirements shown in Charts A to F.

Shown on the attached charts are our Furnas relay selections:

Chart Carlyle Compressor Model

A	06ER
B	06EM
C	06EA
D	06TR
E	06TA
F	06CC

Carlyle has reviewed the Furnas overload relay with UL. The device is listed and is suitable for motor overload protection. It does not provide the branch circuit protection offered by the calibrated circuit breaker. The motor and relay have to be protected by a listed overcurrent device located upstream. This may be a fuse or circuit breaker that meets local and national branch circuit protection code requirements. In general, this typically requires a listed circuit breaker having a rating not exceeding 225% of the compressor RLA.

CHART A
FURNAS 958 SERIES SOLID STATE RELAYS
06ER - ELECTRICAL SPECIFICATIONS

COMPRESSOR MOTOR DATA				FURNAS SOLID STATE RELAY SELECTIONS						ALTERNATE		
COMPRESSOR MODEL	VOLT	HP	SEE NOTE #1		SEE NOTE #2		CARLYLE FURNAS RELAY PART NO.	FURNAS RELAY VENDOR PART NO.	RECOMMENDED SETTINGS		SEE NOTE #3 RECOMM. RLA	
			MAX TRIP AMPS	MAX RLA	LRA	XL			LRA PW (1ST WINDING)	M.H.		M.T.
06ER(1/4)50300	208/230	15	90	72	283	170	HN76JZ050	958-DA-32B	80	89.6	64.0	HH83XB356
06ER(1/4)50100	575	38	36	31	98	59	HN76JZ015	958-AA-32B	30	33.6	24.0	HH83XA460
06ER(1/4)50600	460	46	46	36	142	85	HN76JZ022	958-BA-32B	40	44.8	32.0	HH83XA463
06ER(1/4)65300	208/230	20	108	87	345	207	HN76JZ050	958-DA-32B	95	106.4	76.0	HH83XB336
06ER(1/4)65100	575	45	45	36	120	72	HN76JZ022	958-BA-32B	40	44.8	32.0	HH83XA461
06ER(1/4)65600	460	54	54	44	173	104	HN76JZ022	958-BA-32B	44	49.3	35.2	HH83XA424
06ER(1/4)75300	208/230	20	108	87	345	207	HN76JZ050	958-DA-32B	95	106.4	76.0	HH83XB336
06ER(1/4)75100	575	45	45	36	120	72	HN76JZ022	958-BA-32B	40	44.8	32.0	HH83XA461
06ER(1/4)75600	460	54	54	44	173	104	HN76JZ022	958-BA-32B	44	49.3	35.2	HH83XA424
06ER(0/3)99300	208/230	30	168	135	506	304	HN76JZ075	958-EA-32B	150	168	120.0	HH83XC539
06ER(0/3)99100	575	65	65	52	176	106	HN76JZ033	958-CA-32B	56	62.7	44.8	HH83XA430
06ER(0/3)99600	460	84	84	68	253	152	HN76JZ033	958-CA-32B	66	73.9	52.8	HH83XA425

Legend:
 RLA = Rated Load Amps
 LRA = Locked Rotor Amps
 XL = Across-the-Line Start

PW = Part-Winding Start
 MH = Must Hold Amps
 MT = Must Trip Amps

- Notes:**
- Compressor must trip amps and RLA are maximum figures. See write-up on Carlyle Compressor Amperage Ratings for 06E compressors.
 - LRA value for PW 2nd winding = 1/2 the LRA XL value.
 - Recommended RLA value = Crk Brk must trip value / 1.4. Use this recommended RLA value to determine minimum contactor sizing and wire sizing. See also detail on Compressor Amperage Ratings.

Recommend Manual Reset -
 Model Shown Above

CHART B
FURNAS 958 SERIES SOLID STATE RELAYS
06EM - ELECTRICAL SPECIFICATIONS

COMPRESSOR MOTOR DATA				FURNAS SOLID STATE RELAY SELECTIONS						ALTERNATE		
COMPRESSOR MODEL	VOLT	HP	SEE NOTE #1		SEE NOTE #2		CARLYLE FURNAS RELAY PART NO.	FURNAS RELAY VENDOR PART NO.	RECOMMENDED SETTINGS		SEE NOTE #3 RECOMM. RLA	
			MAX MUST TRIP AMPS	MAX RLA	LRA XL (1ST WINDING)	LRA PW			M.H.	M.T.		
06EM(1/4)50300	208/230		90	72	283	170	HN76JZ050	958-DA-32B	80	89.6	64.0	HH83XB356
06EM(1/4)50100	575	15	38	31	98	59	HN76JZ015	958-AA-32B	30	33.6	24.0	HH83XA460
06EM(1/4)50600	460		46	36	142	85	HN76JZ022	958-BA-32B	40	44.8	32.0	HH83XA463
06EM(1/4)75300	208/230		140	112	446	268	HN76JZ075	958-EA-32B	120	134.4	96.0	HH83XC509
06EM(1/4)75100	575	25	57	46	164	98	HN76JZ022	958-BA-32B	44	49.3	35.2	HH83XA469
06EM(1/4)75600	460		70	56	223	134	HN76JZ033	958-CA-32B	60	67.2	48.0	HH83XA426
06EM(1/4)99300	208/230		193	155	610	366	HN76JZ090	958-FA-32B	168	188.2	134.4	HH83XC532
06EM(1/4)99100	575	35	77	62	212	127	HN76JZ033	958-CA-32B	66	73.9	52.8	HH83XA453
06EM(1/4)99600	460		96	77	305	183	HN76JZ050	958-DA-32B	78	87.4	62.4	HH83XA547

Legend:
 RLA = Rated Load Amps
 LRA = Locked Rotor Amps
 XL = Across-the-Line Start
 PW = Part-Winding Start
 MH = Must Hold Amps
 MT = Must Trip Amps
 Recommend Manual Reset - Model Shown Above

Notes:

1. Compressor must trip amps and RLA are maximum figures. See write-up on Carlyle Compressor Amperage Ratings for 06E compressors.
2. LRA value for PW 2nd winding = 1/2 the LRA XL value.
3. Recommended RLA value = Crt Brk must trip value / 1.4. Use this recommended RLA value to determine minimum contactor sizing and wire sizing. See also detail on Compressor Amperage Ratings.

CHART C
FURNAS 958 SERIES SOLID STATE RELAYS
06EA - ELECTRICAL SPECIFICATIONS

COMPRESSOR MODEL	VOLT	HP	COMPRESSOR MOTOR DATA				SEE NOTE #1				SEE NOTE #2				FURNAS SOLID STATE RELAY SELECTIONS				ALTERNATE CIRCUIT BREAKER PART NO.		
			MAX TRIP AMPS	MAX RLA	LRA	XL	LRA PW (1ST WINDING)	CARLYLE FURNAS RELAY PART NO.	FURNAS RELAY VENDOR PART NO.	RECOMMENDED SETTINGS		SEE NOTE #3 RECOMM. RLA									
										M.H.	M.T.										
06EA(2/5)50300	208/230		108	87	345	207															
06EA(2/5)50100	575	20	45	36	120	59															76.0
06EA(2/5)50600	460		54	44	173	85															32.0
06EA(2/5)65300	208/230		140	112	446	268															35.2
06EA(2/5)65100	575	25	57	46	164	98															96.0
06EA(2/5)65600	460		70	56	223	134															35.2
06EA(2/5)75300	208/230		168	135	506	304															48.0
06EA(2/5)75100	575	30	65	52	176	106															120.0
06EA(2/5)75600	460		84	68	253	152															44.8
06EA(2/5)99300	208/230		236	189	690	414															52.8
06EA(2/5)99100	575	40	94	75	276	165															144.0
06EA(2/5)99600	460		118	95	345	207															64.0

Legend:

RLA = Rated Load Amps
 LRA = Locked Rotor Amps
 XL = Across-the-Line Start

PW = Part-Winding Start
 MH = Must Hold Amps
 MT = Must Trip Amps

Notes:

- Compressor must trip amps and RLA are maximum figures. See write-up on Carlyle Compressor Amperage Ratings for 06E compressors.
- LRA value for PW 2nd winding = 1/2 the LRA XL value.
- Recommended RLA value = Crk Brk must trip value / 1.4. Use this recommended RLA value to determine minimum contactor sizing and wire sizing. See also detail on Compressor Amperage Ratings.

CHART D
FURNAS 958 SERIES SOLID STATE RELAYS
06TR - ELECTRICAL SPECIFICATIONS

COMPRESSOR MODEL	VOLT	HP	SEE NOTE #1			SEE NOTE #2		FURNAS SOLID STATE RELAY SELECTIONS			ALTERNATE CIRCUIT BREAKER PART NO.	
			MAX TRIP AMPS	MAX RLA	LRA	LRA PW (1ST WINDING)	CARLYLE FURNAS RELAY PART NO.	FURNAS RELAY VENDOR PART NO.	RECOMMENDED SETTINGS			SEE NOTE #3 RECOMM. RLA
									M.H.	M.T.		
06TRC033F2EA-A00	208/230	15	90	64	286	186	HN76JZ050	958-DA-32B	80	99.6	64.0	HH83XB626
06TRC033C2EA-A00	575	15	33.5	24	114	66	HN76JZ015	958-AA-32B	29	32.5	23.2	HH83XA460
06TRC033B2EA-A00	460	15	46	33	142	82	HN76JZ022	958-BA-32B	40	44.8	32.0	HH83XA463
06TRD039F2EA-A00	208/230	20	104	74	348	202	HN76JZ050	958-DA-32B	92	103	73.6	HH83XB625
06TRD039C2EA-A00	575	20	39	28	138	80	HN76JZ022	958-BA-32B	34	38.1	27.2	HH83XA461
06TRD039B2EA-A00	460	20	49	35	173	100	HN76JZ022	958-BA-32B	43	48.2	34.4	HH83XA424
06TRD044F2EA-A00	208/230	20	104	74	348	202	HN76JZ050	958-DA-32B	92	103	73.6	HH83XB625
06TRD044C2EA-A00	575	20	39	28	138	80	HN76JZ022	958-BA-32B	34	38.1	27.2	HH83XA461
06TRD044B2EA-A00	460	20	49	35	173	100	HN76JZ022	958-BA-32B	43	48.2	34.4	HH83XA424
06TRE048F2EA-A00	208/230	25	128	91.0	433	251	HN76JZ075	958-EA-32B	114	127.7	91.2	HH83XC509
06TRE048C2EA-A00	575	25	53	38.0	172	100	HN76JZ022	958-BA-32B	44	49.3	35.2	HH83XA469
06TRE048B2EA-A00	460	25	64	46.0	215	125	HN76JZ033	958-CA-32B	56	62.7	44.8	HH83XA426
06TRE054F2EA-A00	208/230	25	128	91.0	433	251	HN76JZ075	958-EA-32B	114	127.7	91.2	HH83XC509
06TRE054C2EA-A00	575	25	53	38.0	172	100	HN76JZ022	958-BA-32B	44	49.3	35.2	HH83XA469
06TRE054B2EA-A00	460	25	64	46.0	215	125	HN76JZ033	958-CA-32B	56	62.7	44.8	HH83XA426
06TRF065F2EA-A00	208/230	30	154	110	611	216	HN76JZ075	958-EA-32B	136	152.3	108.8	HH83XC573
06TRF065C2EA-A00	575	30	62	44	219	78	HN76JZ033	958-CA-32B	55	61.6	44.0	HH83XB617
06TRF065B2EA-A00	460	30	76	54	274	97	HN76JZ033	958-CA-32B	66	73.9	52.8	HH83XA474
06TRG078F2EA-A00	208/230	35	181	129	721	255	HN76JZ090	958-FA-32B	180	179.2	128.0	HH83XC574
06TRG078C2EA-A00	575	35	72	51	258	91	HN76JZ033	958-CA-32B	64	71.7	51.2	HH83XB618
06TRG078B2EA-A00	460	35	89	64	323	114	HN76JZ050	958-DA-32B	78	87.4	62.4	HH83XA475
06TRH088F2EA-A00	208/230	40	203	146	825	292	HN76JZ090	958-FA-32B	180	207.6	144.0	HH83XC575
06TRH088C2EA-A00	575	40	81	58	296	105	HN76JZ050	958-DA-32B	72	80.6	57.6	HH83XB619
06TRH088B2EA-A00	460	40	101	72	370	131	HN76JZ050	958-DA-32B	90	100.8	72.0	HH83XA476
06RTK108B2EA-A00	400-3-50	50	114	81	440	155	HN76JZ050	958-DA-32B	100	112	80.0	HH83XA477

Legend:

RLA = Rated Load Amps
 LRA = Locked Rotor Amps
 XL = Across-the-Line Start

PW = Part-Winding Start
 MH = Must Hold Amps
 MT = Must Trip Amps

Notes:

- Compressor must trip amps and RLA are maximum figures. See write-up on Carlyle Compressor Amperage Ratings for 06E compressors.
- LRA value for PW 2nd winding = 1/2 the LRA XL value.
- Recommended RLA value = Crk Brk must trip value / 1.4. Use this recommended RLA value to determine minimum contactor sizing and wire sizing. See also detail on Compressor Amperage Ratings.

**CHART E
FURNAS 958 SERIES SOLID STATE RELAYS
06TA - ELECTRICAL SPECIFICATIONS**

COMPRESSOR MODEL	VOLT	HP	SEE NOTE #1				SEE NOTE #2		FURNAS SOLID STATE RELAY SELECTIONS				ALTERNATE CIRCUIT BREAKER PART NO.
			MAX TRIP AMPS	MAX RLA	LRA	XL	LRA PW (1ST WINDING)	CARLYLE FURNAS RELAY PART NO.	FURNAS RELAY VENDOR PART NO.	RECOMMENDED SETTINGS		RECOMM. RLA	
										M.H.	M.T.		
06TAD033F2EA-A00	208/230		104	74	348	202	HN76JZ050	958-DA-32B	92	103	73.6	HH83XB625	
06TAD033C2EA-A00	575	20	39	28	138	80	HN76JZ022	958-BA-32B	34	38.1	27.2	HH83XA461	
06TAD033B2EA-A00	460		49	35	173	100	HN76JZ022	958-BA-32B	43	48.2	34.4	HH83XA424	
06TAE039F2EA-A00	208/230		128	91.0	433	251	HN76JZ075	958-EA-32B	114	127.7	91.2	HH83XC509	
06TAE039C2EA-A00	575	25	53	38.0	172	100	HN76JZ022	958-BA-32B	44	49.3	35.2	HH83XA469	
06TAE039B2EA-A00	460		64	46.0	215	125	HN76JZ033	958-CA-32B	56	62.7	44.8	HH83XA426	
06TAF044F2EA-A00	208/230		183	116.0	510	304	HN76JZ075	958-EA-32B	144	161.3	115.2	HH83XC539	
06TAF044C2EA-A00	575	30	62	44.0	202	117	HN76JZ033	958-CA-32B	52	58.2	41.6	HH83XA430	
06TAF044B2EA-A00	460		78	54.0	253	152	HN76JZ033	958-CA-32B	65	72.8	52.0	HH83XA425	
06TAF048F2EA-A00	208/230		163	116.0	510	304	HN76JZ075	958-EA-32B	144	161.3	115.2	HH83XC539	
06TAF048C2EA-A00	575	30	62	44.0	202	117	HN76JZ033	958-CA-32B	52	58.2	41.6	HH83XA430	
06TAF048B2EA-A00	460		76	54.0	253	152	HN76JZ033	958-CA-32B	65	72.8	52.0	HH83XA425	
06TAG054F2EA-A00	208/230		182	130	610	366	HN76JZ090	958-FA-32B	162	181.4	129.6	HH83XC632	
06TAG054C2EA-A00	575	35	78	56	242	137	HN76JZ050	958-DA-32B	69	77.3	55.2	HH83XA453	
06TAG054B2EA-A00	460		88	63	305	183	HN76JZ050	958-DA-32B	78	87.4	62.4	HH83XA547	
06TAG065F2EA-A00	208/230		181	129	721	255	HN76JZ090	958-FA-32B	161	180.3	128.8	HH83XC574	
06TAG065C2EA-A00	575	35	72	51	258	91	HN76JZ050	958-DA-32B	69	77.3	55.2	HH83XB618	
06TAG065B2EA-A00	460		89	64	323	114	HN76JZ050	958-DA-32B	78	87.4	62.4	HH83XA475	
06TAH078F2EA-A00	208/230		203	146	825	292	HN76JZ090	958-FA-32B	180	201.6	144.0	HH83XC575	
06TAH078C2EA-A00	575	40	81	58	296	105	HN76JZ050	958-DA-32B	72	80.6	57.6	HH83XB619	
06TAH078B2EA-A00	460		101	72	370	131	HN76JZ050	958-DA-32B	90	100.8	72.0	HH83XA476	
06TAK088F2EA-A00	208/230 PW Start		230	165	974	347	HN76JZ050	958-DA-32B	200*	224	160.0	HH83XC576	
06TAK088C2EA-A00	575	50	92	66	351	124	HN76JZ050	958-DA-32B	78	87.4	62.4	HH83XB610	
06TAK088B2EA-A00	460		114	81	440	155	HN76JZ050	958-DA-32B	100	112	80.0	HH83XA477	

Legend:

RLA = Rated Load Amps
LRA = Locked Rotor Amps
XL = Across-the-Line Start

PW = Part-Winding Start
MH = Must Hold Amps
MT = Must Trip Amps

Notes:

- Compressor must trip amps and RLA are maximum figures. See write-up on Carlyle Compressor Amperage Ratings for 06E compressors.
- LRA value for PW 2nd winding = 1/2 the LRA XL value.
- Recommended RLA value = Crt Brk must trip value / 1.4. Use this recommended RLA value to determine minimum contactor sizing and wire sizing. See also detail on Compressor Amperage Ratings.
- * 06TAK088F2EA-A00 compressor requires the use of two furnas overloads in parallel along with two contactors. Furnas must hold setting = 100

CHART F
FURNAS 958 SERIES SOLID STATE RELAYS
06CC - ELECTRICAL SPECIFICATIONS

COMPRESSOR MOTOR DATA				FURNAS SOLID STATE RELAY SELECTIONS						ALTERNATE		
COMPRESSOR MODEL	VOLT	HP	SEE NOTE #1		SEE NOTE #2		CARLYLE FURNAS RELAY PART NO.	FURNAS RELAY VENDOR PART NO.	RECOMMENDED SETTINGS		SEE NOTE #3 RECOMM. RLA	CIRCUIT BREAKER PART NO.
			MAX TRIP AMPS	RLA	LRA	XL			LRA PW (1ST WINDING)	M.H.		
06CC550E100	208/230		68	54	283	170	HN76JZ033	958-CA-32B	60	67.2	48.0	HH83XB455
06CC550J100	575	15	27	22	98	59	HN76JZ015	958-AA-32B	24	26.9	19.2	HH83XB438
06CC550F100	460		32	26	142	85	HN76JZ015	958-AA-32B	28	31.4	22.4	HH83XB414
06CC665E100	208/230		100	80	345	207	HN76JZ050	958-DA-32B	75	84.0	60.0	HH83XB376
06CC665J100	575	20	38	30	120	72	HN76JZ022	958-BA-32B	34	38.1	27.2	HH83XB461
06CC665F100	460		50	40	173	104	HN76JZ022	958-BA-32B	44	49.3	35.2	HH83XB437
06CC675E100	208/230		100	80	345	207	HN76JZ050	958-DA-32B	80	89.6	64.0	HH83XB378
06CC675J100	575	20	40	32	120	72	HN76JZ022	958-BA-32B	36	40.3	28.8	HH83XB422
06CC675F100	460		50	40	173	104	HN76JZ022	958-BA-32B	44	49.3	35.2	HH83XB437
06CC899E100	208/230		141	113	506	304	HN76JZ075	958-EA-32B	125	140.0	100.0	HH83XC406
06CC899J100	575	30	58	46	176	106	HN76JZ033	958-CA-32B	52	58.2	41.6	HH83XB430
06CC899F100	460		73	58	253	152	HN76JZ033	958-CA-32B	65	72.8	52.0	HH83XB432

Legend:
 RLA = Rated Load Amps
 LRA = Locked Rotor Amps
 XL = Across-the-Line Start
 PW = Part-Winding Start
 MH = Must Hold Amps
 MT = Must Trip Amps
 Recommend Manual Reset - Model Shown Above

- Notes:**
- Compressor must trip amps and RLA are maximum figures. See write-up on Carlyle Compressor Amperage Ratings for 06E compressors.
 - LRA value for PW 2nd winding = 1/2 the LRA XL value.
 - Recommended RLA value = Crt Brk must trip value / 1.4. Use this recommended RLA value to determine minimum contactor sizing and wire sizing. See also detail on Compressor Amperage Ratings.