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OUTDOOR PUMPING STATION APPLICATION UTILISING VSC (IP66) IN OUTDOOR VENTILATED CUBICLE AND PASSIVE FILTERS (IP20) IN OUTDOOR MK8 CUBICLES

TABLE 1
MOTOR CURRENT RANGE

MOTOR FLC RANGE (AMPERES)
0–1.0A
1.1–1.4A
1.5–1.9A
2.0–2.4A
2.5–3.3A
3.4–4.5A
4.6–5.8A
5.9–8.0A
8.1–10.4A
10.5–12.8A
12.9–20.4A
20.5–27.2A
27.3–31.9A
32.0–37.4A
37.5–51.9A
52.0–62.1A
62.2–76.5A
76.6–90.1A
90.2–125A
125.1–150.5A

TABLE 2
VSC FEEDER PANEL SELECTION

VSC FEEDER PANEL DESIGNATION	VSC FEEDER VERSION DESIGNATION
A	*A1*
	A2
B	*B1*
	B2
	B3
	B4
	B5
C	*C1*
	C2
D	*D1*
	D2

VSC FEEDER PANEL HOUSED IN A Mk8 OUTDOOR IP56 RATED CUBICLE

TABLE 3
VSC HARMONIC FILTER SELECTION (IF REQUIRED)
(SEE DESIGN NOTE 15)

VSC HARMONIC FILTER (AHF 005)	VSC HARMONIC FILTER (AHF 010)	MAXIMUM OPERATING AMBIENT TEMPERATURE	MAXIMUM ACOUSTIC NOISE LEVEL
130B1229	130B1027	50ºC	<70 dB(A)
130B1229	130B1027	50ºC	<70 dB(A)
130B1229	130B1027	50ºC	<70 dB(A)
130B1229	130B1027	50ºC	<70 dB(A)
130B1229	130B1027	50ºC	<70 dB(A)
130B1229	130B1027	50ºC	<70 dB(A)
130B1229	130B1027	50ºC	<70 dB(A)
130B1229	130B1027	50ºC	<70 dB(A)
130B1231	130B1058	50ºC	<70 dB(A)
130B1231	130B1058	50ºC	<70 dB(A)
	130B1059	50ºC	<70 dB(A)
	130B1089	50ºC	<70 dB(A)
	130B1094	50ºC	<72 dB(A)

(SEE DESIGN NOTES 8 AND 9)

VSC HARMONIC FILTER PANEL HOUSED IN A Mk8 OUTDOOR IP56 RATED CUBICLE

TABLE 4
VARIABLE SPEED CONTROLLER (VSC) SELECTION
(SEE DESIGN NOTE 15)

VSC CONTINUOUS OUTPUT CURRENT AT MAXIMUM OPERATING AMBIENT TEMPERATURE (AMPERES)	VSC MODEL	MAXIMUM OPERATING AMBIENT TEMPERATURE	MAXIMUM ACOUSTIC NOISE LEVEL
1.0	PK37	50ºC	<60 dB(A)
1.4	PK55	50ºC	<60 dB(A)
1.9	PK75	50ºC	<60 dB(A)
2.4	P1K1	50ºC	<60 dB(A)
3.3	P1K5	50ºC	<60 dB(A)
4.5	P2K2	50ºC	<60 dB(A)
5.8	P3K0	50ºC	<60 dB(A)
8.0	P4K0	50ºC	<60 dB(A)
10.4	P5K5	50ºC	<63 dB(A)
12.8	P7K5	50ºC	<63 dB(A)
20.4	P11K	50ºC	<67 dB(A)
27.2	P15K	50ºC	<67 dB(A)
31.9	P22K	50ºC	<70 dB(A)
37.4	P30K	50ºC	<70 dB(A)
51.9	P37K	50ºC	<62 dB(A)
62.1	P45K	50ºC	<62 dB(A)
76.5	P55K	50ºC	<62 dB(A)
90.1	P75K	50ºC	<65 dB(A)
125.0	P90K	50ºC	<65 dB(A)
150.5	P90K	45ºC	<65 dB(A)

VARIABLE SPEED CONTROLLER HOUSED IN A Mk8 OUTDOOR VENTILATED IP20 RATED CUBICLE

TABLE 5
VSC SINE–WAVE FILTER SELECTION (IF REQUIRED)
(SEE DESIGN NOTE 15)

SINE FILTER MODEL	MINIMUM SWITCHING FREQUENCY	MAXIMUM OPERATING AMBIENT TEMPERATURE	MAXIMUM ACOUSTIC NOISE LEVEL
130B2439	5kHz	55ºC	<60 dB(A)
130B2439	5kHz	55ºC	<60 dB(A)
130B2439	5kHz	55ºC	<60 dB(A)
130B2439	5kHz	55ºC	<60 dB(A)
130B2441	5kHz	55ºC	<60 dB(A)
130B2443	5kHz	55ºC	<60 dB(A)
130B2443	5kHz	55ºC	<60 dB(A)
130B2444	5kHz	55ºC	<60 dB(A)
130B2446	5kHz	55ºC	<63 dB(A)
130B2446	5kHz	55ºC	<63 dB(A)
130B2447	4kHz	55ºC	<67 dB(A)
130B2448	4kHz	55ºC	<67 dB(A)
130B2448	4kHz	55ºC	<70 dB(A)
130B2307	4kHz	55ºC	<70 dB(A)
130B2308	3kHz	55ºC	<62 dB(A)
130B2309	3kHz	55ºC	<62 dB(A)

(SEE DESIGN NOTES 10 AND 11)

VSC SINE–WAVE FILTER PANEL HOUSED IN A Mk8 OUTDOOR IP56 RATED CUBICLE

TABLE 6
VSC dV/dT FILTER SELECTION (IF REQUIRED)
(SEE DESIGN NOTE 15)

dV/dT FILTER MODEL	MAXIMUM OPERATING AMBIENT TEMPERATURE	MAXIMUM ACOUSTIC NOISE LEVEL
(SEE DESIGN NOTE 12)		
130B2836	55ºC	<67 dB(A)
130B2836	55ºC	<67 dB(A)
130B2836	55ºC	<70 dB(A)
130B2836	55ºC	<70 dB(A)
130B2839	55ºC	<62 dB(A)
130B2839	55ºC	<62 dB(A)
130B2839	55ºC	<62 dB(A)
130B2842	55ºC	<62 dB(A)
130B2845	55ºC	<65 dB(A)
130B2845	55ºC	<65 dB(A)

VSC dV/dT FILTER PANEL HOUSED IN A Mk8 OUTDOOR IP56 RATED CUBICLE

PUMPING STATION APPLICATION UTILISING VSC (IP66 OR IP54) AND PASSIVE FILTERS (IP20) IN TEMPERATURE CONTROLLED ENVIRONMENT

TABLE 1
MOTOR CURRENT RANGE

MOTOR FLC RANGE (AMPERES)
12.9–20.4A
20.5–27.2A
27.3–31.9A
32.0–37.4A
37.5–51.9A
52.0–62.1A
62.2–76.5A
76.6–90.1A
90.2–125.0A
125.1–150.5A
150.6–180.2A
180.3–221A
221.1–267.8A

TABLE 2
VSC FEEDER PANEL SELECTION

VSC FEEDER PANEL DESIGNATION	VSC FEEDER VERSION DESIGNATION
B	*B1*
	B2
	B3
	B4
	B5
C	*C1*
	C2
D	*D1*
	D2
E	*E1*
F	*F1*
	F2

VSC FEEDER PANEL HOUSED IN A Mk8 OUTDOOR IP56 RATED CUBICLE

TABLE 3
VSC HARMONIC FILTER SELECTION (IF REQUIRED)
(SEE DESIGN NOTE 15)

VSC HARMONIC FILTER (AHF 005)	VSC HARMONIC FILTER (AHF 010)	MAXIMUM OPERATING AMBIENT TEMPERATURE	MAXIMUM ACOUSTIC NOISE LEVEL
130B1232		45ºC	<70 dB(A)
130B1233		45ºC	<70 dB(A)
130B1238		45ºC	<70 dB(A)
130B1239	130B1111	45ºC	<72 dB(A)
130B1241	130B1180	45ºC	<72 dB(A)
130B1247	130B1201	45ºC	<72 dB(A)
130B1248	130B1204	45ºC	<72 dB(A)
130B1249	130B1207	45ºC	<75 dB(A)
130B1250	130B1213	45ºC	<75 dB(A)
130B1250	130B1213	45ºC	<75 dB(A)
130B1251	130B1214	45ºC	<75 dB(A)
130B1258	130B1215	45ºC	<75 dB(A)
130B1259	130B1216	45ºC	<75 dB(A)

VSC HARMONIC FILTER WALL MOUNTED IN TRANSPORTABLE TEMPERATURE CONTROLLED MODULE

TABLE 4
VARIABLE SPEED CONTROLLER (VSC) SELECTION
(SEE DESIGN NOTE 15)

VSC CONTINUOUS OUTPUT CURRENT AT MAXIMUM OPERATING AMBIENT TEMPERATURE (AMPERES)	VSC MODEL	MAXIMUM OPERATING AMBIENT TEMPERATURE	MAXIMUM ACOUSTIC NOISE LEVEL
20.4	P11K	50ºC	<67 dB(A)
27.2	P15K	50ºC	<67 dB(A)
31.9	P22K	50ºC	<70 dB(A)
37.4	P30K	50ºC	<70 dB(A)
51.9	P37K	50ºC	<62 dB(A)
62.1	P45K	50ºC	<62 dB(A)
76.5	P55K	50ºC	<62 dB(A)
90.1	P75K	50ºC	<65 dB(A)
125.0	P90K	50ºC	<65 dB(A)
150.5	P90K	45ºC	<65 dB(A)
180.2	N110K	45ºC	<73 dB(A)
221	N132	45ºC	<73 dB(A)
267.8	N160	45ºC	<73 dB(A)

VSC WALL MOUNTED IN TRANSPORTABLE TEMPERATURE CONTROLLED MODULE

TABLE 5
VSC SINE–WAVE FILTER SELECTION (IF REQUIRED)
(SEE DESIGN NOTE 15)

SINE FILTER MODEL	MINIMUM SWITCHING FREQUENCY	MAXIMUM OPERATING AMBIENT TEMPERATURE	MAXIMUM ACOUSTIC NOISE LEVEL
130B3181	3kHz	45ºC	<62 dB(A)
130B3181	3kHz	45ºC	<65 dB(A)
130B3183	3kHz	45ºC	<65 dB(A)
130B3183	3kHz	45ºC	<65 dB(A)
130B3183	3kHz	45ºC	<73 dB(A)
130B3185	3kHz	45ºC	<73 dB(A)
130B3187	3kHz	45ºC	<73 dB(A)

VSC SINE–WAVE FILTER WALL OR FLOOR MOUNTED IN TRANSPORTABLE TEMPERATURE CONTROLLED MODULE

TABLE 6
VSC dV/dT FILTER SELECTION (IF REQUIRED)
(SEE DESIGN NOTE 15)

dV/dT FILTER MODEL	MAXIMUM OPERATING AMBIENT TEMPERATURE	MAXIMUM ACOUSTIC NOISE LEVEL
130B2839	45ºC	<62 dB(A)
130B2842	45ºC	<62 dB(A)
130B2845	45ºC	<65 dB(A)
130B2845	45ºC	<65 dB(A)
130B2848	45ºC	<73 dB(A)
130B2848	45ºC	<73 dB(A)
130B2848	45ºC	<73 dB(A)

VSC dV/dT FILTER WALL OR FLOOR MOUNTED IN TRANSPORTABLE TEMPERATURE CONTROLLED MODULE

DESIGN NOTES

1. *DUE TO THE COMPLEX NATURE OF VARIABLE SPEED CONTROLLER APPLICATION DESIGN, THE ELECTRICAL DESIGN ENGINEER SHALL ENSURE THAT THE PRIMARY DESIGN IS IN ACCORDANCE WITH ALL THE REQUIREMENTS SPECIFIED FOR VARIABLE SPEED CONTROLLERS IN DESIGN STANDARD DS22*
2. *THE VARIABLE SPEED CONTROLLERS HAVE SPECIFICALLY BEEN SELECTED ON TECHNICAL GROUNDS FROM THE DANFOSS VLT AQUA DRIVE FC–202 PRODUCT RANGE AND SHALL NOT BE SUBSTITUTED FOR ANOTHER BRAND OR MODEL WITHOUT WRITTEN CONSENT FROM THE SENIOR PRINCIPAL ENGINEER – ELECTRICAL, ENGINEERING*
3. *THE VARIABLE SPEED CONTROLLER HARMONIC, SINE–WAVE AND dV/dT FILTERS HAVE SPECIFICALLY BEEN SELECTED ON TECHNICAL GROUNDS FROM THE DANFOSS VLT PRODUCT RANGE AND SHALL NOT BE SUBSTITUTED FOR ANOTHER BRAND OR MODEL WITHOUT WRITTEN CONSENT FROM THE SENIOR PRINCIPAL ENGINEER – ELECTRICAL, ENGINEERING*
4. *VARIABLE SPEED CONTROLLERS INCLUDED IN THE STANDARD DESIGNS, ARE DANFOSS VLT AQUA DRIVE FC202 SERIES DEVICES WHICH INCLUDE EMC FILTERING, CONFORMAL COATINGS (3C3) IN ACCORDANCE WITH IEC 60721–3.3:2019 AND HAVE AN INGRESS PROTECTION RATING OF IP66. THEY SHALL NOT BE SUBSTITUTED WITH OTHER MAKES OR MODELS OF VARIABLE SPEED CONTROLLERS WITHOUT RE–EVALUATION OF THE ENTIRE DESIGN*
5. *THE VARIABLE SPEED CONTROLLERS AND FILTERS PRODUCE ACOUSTIC NOISE, FOR OUTDOOR APPLICATIONS THE ELECTRICAL DESIGN ENGINEER SHALL ASSESS ACCEPTABLE NOISE LEVELS FOR EACH PROJECT AND TAKE ACOUSTIC NOISE LIMITING MEASURES*
6. *FOR INDOOR VSC AND FILTER APPLICATIONS (TEMPERATURE CONTROLLED ENVIRONMENT – PLANNED FUTURE DESIGN) THE ELECTRICAL DESIGN ENGINEER SHALL ASSESS ACCEPTABLE NOISE LEVELS CREATED BY AIR CONDITIONERS FOR EACH PROJECT AND TAKE ACOUSTIC NOISE LIMITING MEASURES*
7. *AGGRESSIVE ATMOSPHERES DAMAGE VARIABLE SPEED CONTROLLER AND FILTER COMPONENTS, FOR OUTDOOR APPLICATIONS THE ELECTRICAL DESIGN ENGINEER SHALL ASSESS ENVIRONMENTAL CONDITIONS AND TAKE MEASURES TO REDUCE CORROSIVE ATMOSPHERE ATTACK*
8. *ADVANCED HARMONIC FILTERS (AHF 005) IN THE VSC CURRENT OUTPUT RANGE 12.9A TO 150.5A CANNOT BE HOUSED IN STANDARD OUTDOOR CUBICLES DUE TO HEAT AND/OR WEIGHT CONSTRAINTS*
9. *ADVANCED HARMONIC FILTERS (AHF 010) IN THE VSC CURRENT OUTPUT RANGE 32.0A TO 150.5A CANNOT BE HOUSED IN STANDARD OUTDOOR CUBICLES DUE TO HEAT AND/OR WEIGHT CONSTRAINTS*
10. *SINE–WAVE FILTERS IN THE VSC CURRENT OUTPUT RANGE 62.2A TO 150.5A CANNOT BE HOUSED IN STANDARD CUBICLES DUE TO HEAT, PHYSICAL SIZE AND WEIGHT CONSTRAINTS*
11. *SINE–WAVE FILTERS IN THE VSC CURRENT OUTPUT RANGE 62.2A TO 150.5A CAN BE HOUSED INDOORS INSIDE A TEMPERATURE CONTROLLED ENVIRONMENT. (PLANNED FUTURE DESIGN)*
12. *dV/dT FILTERS ARE NOT AVAILABLE IN THE VSC CURRENT OUTPUT RANGES BELOW 12.9A*
13. *dV/dT FILTERS IN THE VSC CURRENT OUTPUT RANGE 150.6A TO 267.8A CANNOT BE HOUSED IN STANDARD CUBICLES DUE TO HEAT AND PHYSICAL SIZE CONSTRAINTS*
14. *dV/dT FILTERS IN THE VSC CURRENT OUTPUT RANGE 150.6A TO 267.8A CAN BE HOUSED INDOORS INSIDE A TEMPERATURE CONTROLLED ENVIRONMENT. (PLANNED FUTURE DESIGN)*
15. *VARIABLE SPEED CONTROLLER, HARMONIC FILTER, SINE–WAVE FILTER AND dV/dT FILTER SELECTION IS BASED ON NOMINAL MOTOR CURRENT. FILTERS ARE RATED FOR 160% OVERLOAD FOR 1 MINUTE, EVERY 10 MINUTES*
16. *MOTOR THERMAL PROTECTION IS PROVIDED BY ELECTRONIC THERMAL RELAY (ETR) PARAMETER WITHIN VARIABLE SPEED CONTROLLER*

DETERMINATION OF VSC AND VSC FILTER COMBINATIONS

THE CORRECT SELECTION OF COORDINATED DEVICES IS ESSENTIAL FOR PROPER VSC OPERATION, THE INFORMATION IN THE TABLES ABOVE IS DISPLAYED IN ROWS TO ASSIST IN THE CORRECT SELECTION OF MATCHED DEVICES

VSC AND/OR FILTERS REQUIRED FOR PROJECT DESIGN

1. DETERMINE MOTOR CURRENT RANGE REQUIRED TO SUIT MOTOR FULL LOAD CURRENT RATING, REFER TABLE 1
2. DETERMINE VSC FEEDER PANEL VERSION MATCHING REQUIRED MOTOR CURRENT RANGE, REFER TABLE 2
3. IF REQUIRED, DETERMINE VSC HARMONIC FILTER AT MAXIMUM OPERATING AMBIENT TEMPERATURE, REFER TABLE 3 *(SEE DESIGN NOTES 8 AND 9)*
4. DETERMINE VSC MODEL THAT PROVIDES CORRECT OUTPUT CURRENT AT MAXIMUM OPERATING AMBIENT TEMPERATURE, REFER TABLE 4
5. IF REQUIRED, DETERMINE VSC SINE–WAVE FILTER, REFER TABLE 5 *(SEE DESIGN NOTES 10 AND 11)*
6. IF REQUIRED, DETERMINE VSC dV/dT FILTER, REFER TABLE 6 *(SEE DESIGN NOTES 12, 13 AND 14)*

ISSUE	DATE	GRID	REVISION	DRN	REC	APPD

DESIGN SURVEY NONE | VERTICAL DATUM NONE | COORDINATE SYS NONE | ASCON SURVEY NONE | DES REF | DES CALC S GILMOUR | DES CHD T LIU | DRN SA MEMORY | Q.C. CHD P HARVEY

NORTH POINT

SUBMITTED 16/06/2023 SA MEMORY (SIGNED) SENIOR TECHNICAL ADVISOR – ELECT

RECOMMENDED 16/06/2023 S GILMOUR (SIGNED) SENIOR ENGINEER – ELECTRICAL

APPROVED 6/06/2023 T LIU (SIGNED) PRINCIPAL ENGINEER – ELECTRICAL

ENGINEERING

WATER CORPORATION

ELECTRICAL STANDARD SWITCHBOARD DESIGNS
SMALL PUMP STATIONS
PRIMARY DESIGN – VARIABLE SPEED CONTROLLER (VSC)
COORDINATED VSC AND FILTER COMPONENT SELECTION OPTIONS

FILE | PROJECT | PLAN MN01–4–1 | CAD | ISSUE A | ORIGINAL SHEET SIZE A1 | MF

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