

Chapter 13

Cable Management

e-DPP is provided with functions to determine sizes of power cables and associate conduits/glands.

The power cable sizing is performed for electrical loads, e.g. electrical motors static loads, distribution panels and lighting panels stored in the electrical load schedule.

In order to perform the sizing, you need to input all the required data in the edit form dedicated to this purpose. The details are described in the Section 13.1.

Also, the library data of motors and cables are referred by the sizing program.

The conduit and cable gland sizing is performed for all or part of cables (power, control, etc.) stored in the cable schedule.

In order to perform the sizing, "Conduit and Cable Gland Selection Table" needs to be created beforehand with the menu "Cable Management - Conduit and Gland Size".

e-DPP Cable Management menu covers the following features:

- Power Cable Sizing
- Cable Sizing Chart
- Drum Scheduling
- Conduit & Gland Sizing
- Cable Summary
- Gland Summary
- Minimum Cable Size
- Conduit & Gland Size Table

13.1 Power Cable Sizing

Prior to the execution of power cable sizing, the data described below are to be inputted for electrical loads. Select "**All Electrical Loads**" from "**Edit**" menu in the menu bar and then select "**Input Data for Cable Sizing**" from the template list when using the e-DPP standard form.

Motors (Induction, Synchronous and MOV)

- Equip. Code (0, 1, and 2)
- Motor Output
- Unit of Motor Output (HP, kW or KVA) ^{(*)1}
- Motor Rated Voltage (kV) ^{(*)1}
- No. of Phase ^{(*)1}
- Full Load Current (A) ^{(*)1}
- PF at 100% Load (%) ^{(*)1}
- Locked Rotor Current (%) ^{(*)1}
- Locked Rotor PF (%) ^{(*)1}
- Raceway type
- Conductor type (Cu or Al) ^{(*)2}
- Cable Voltage ^{(*)2}
- Cable Type (XLPE/SWA, etc) ^{(*)2}
- No. of Cable Conductors ^{(*)2}
- Unit for No. of Cable Conductors (Usually "Core" for power cables) ^{(*)2}
- Cable Length (m)

DC Motors

Static Loads

Capacitors

Lumped Loads

UPS's

VFD's

Battery Chargers

Heaters

Space Heaters

Feeder Circuits

Lighting Circuits

- Equip. Code (3 to 15)
- Rated Capacity
- Unit of Rated Capacity (HP, kW, KVA or kvar) ^{(*)1}
- Load Rated Voltage (kV)
- Full Load Current (A) ^{(*)1}
- PF at 100% Load (%) ^{(*)1}
- Raceway type
- Conductor type (Cu or Al) ^{(*)2}
- Cable Voltage ^{(*)2}
- Cable Type (XLPE/SWA, etc) ^{(*)2}
- No. of Cable Conductors ^{(*)2}

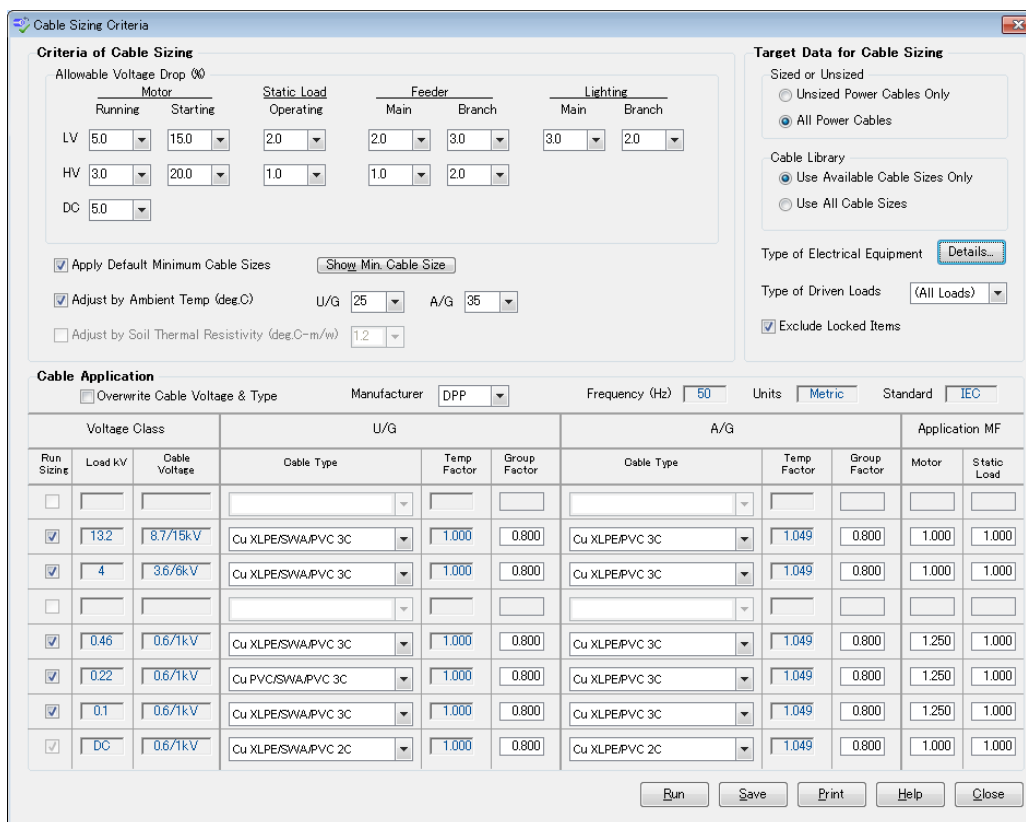
- Unit for No. of Cable Conductors (Usually "Core" for power cables) (*2)
- Cable Length (m)

(*1) The characteristic data for motors and static loads can be filled out with the Data Filling program, as required.

(*2) The data for cable specification may be omitted since the sizing program has the option to fill out user specified defaults. See the section 13.1.1 for further details.

(*3) Power cable ID is not necessarily required for the power cable sizing. However, cables with no ID's will not be transferred to a cable schedule since cable ID is essential.

13.1.1 Cable Sizing Criteria



<Dialog of Cable Sizing Criteria>

When you select the menu "Cable Management" → "Power Cable Sizing", the dialog as shown above will appear. Here, you can specify the various parameters required for the sizing.

Criteria of Cable Sizing

Allowable Voltage Drop (%)

Motor - Running - LV

Allowable voltage drop in % against a system voltage for low voltage motors (kV ≤ 1.0) at normal running. Typical value is 3-5%.

Motor - Starting - LV

Allowable voltage drop in % against a system voltage for low voltage motors ($kV \leq 1.0$) at starting. Typical value is 15-20%.

Motor - Running - HV

Allowable voltage drop in % against a system voltage for high voltage motors ($kV > 1.0$) at normal running. Typical value is 3-5%.

Motor - Starting - HV

Allowable voltage drop in % against a system voltage for high voltage motors ($kV > 1.0$) at starting. Typical value is 15-20%.

Motor - Running - DC

Allowable voltage drop in % against a system voltage for DC voltage motors at normal running. Typical value is 3-10%.

(Note: Starting current of DC motor is not considered.)

Static Load - Operating - LV

Allowable voltage drop in % against a system voltage for low voltage static loads ($kV \leq 1.0$) at normal operation. Typical value is 1-5%.

Static Load - Operating - HV

Allowable voltage drop in % against a system voltage for high voltage static loads ($kV > 1.0$) at normal operation. Typical value is 1-5%.

Feeder - Main - LV

Allowable voltage drop in % against a system voltage for low voltage main feeder circuits going to medium or large distribution panels ($kV \leq 1.0$) at normal operation. Typical value is 1-3%.

Feeder - Branch - LV

Allowable voltage drop in % against a system voltage for low voltage branch feeder circuits going to small distribution panels ($kV \leq 1.0$) at normal operation. Typical value is 2-5%.

Feeder - Main - HV

Allowable voltage drop in % against a system voltage for high voltage main feeder circuits going to medium or large distribution panels ($kV > 1.0$) at normal operation. Typical value is 1-3%.

Feeder - Branch - HV

Allowable voltage drop in % against a system voltage for high voltage branch feeder circuits going to small distribution panels ($kV > 1.0$) at normal operation. Typical value is 2-5%.

Lighting - Main - LV

Allowable voltage drop in % against a system voltage for low voltage main lighting circuits going to medium or large lighting panels ($kV \leq 1.0$) at normal operation. Typical value is 1-5%.

Lighting - Branch - LV

Allowable voltage drop in % against a system voltage for low voltage branch lighting circuits going to small lighting panels ($kV \leq 1.0$) at normal operation. Typical value is 1-5%.

(Note: System voltages are specified in the menu "Project" → "Electrical".)

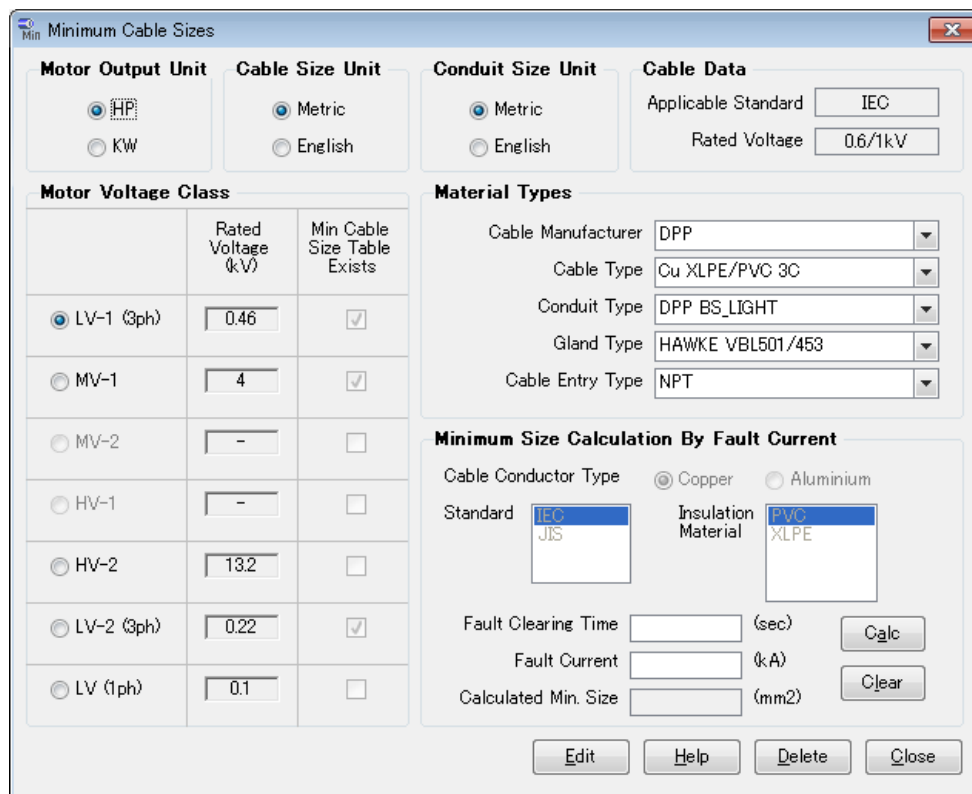
Apply Default Minimum Cable Sizes

Check this box to apply predetermined minimum cable sizes for individual motor loads. When this option is applied and then calculated cable sizes are less than the corresponding minimum cable sizes, the latter is taken as calculation results.

"Show Min. Cable Size" Button

To define or edit the minimum cable sizes for motor loads, click "Show Min. Cable Size" button. "Minimum Cable Sizes" dialog box appears.

(Note: The minimum cable sizes can be also accessed from the menu "Cable Management" → "Minimum Cable Size".)



<Dialog of Minimum Cable Sizes>

When cable sizing is run, the saved values from this dialog box will be reflected on the power cable sizing results.

(Note: For DC motor cables, option for "Minimum Cable Sizes" is ignored.)

Adjust by Ambient Temp. (deg.C) (Ta)

When this option is selected, the temperature adjustment factors **F_{ta}** is calculated (approximately) for each installation method ("U/G" or "A/G") by the difference between the base and actual ambient temperatures of cable installation with the following formula;

$$Fta = \sqrt{\frac{Tc - T}{Tc - Ta}}$$

Where

Tc: Maximum conductor temperature

Ta: Base ambient temperature

T : Actual ambient temperature

Tc and Ta are stored in the cable library. T is selected from the pull down list "U/G" or "A/G" by user. Calculation results are shown in the column "Temp Factor" in "Cable Application" section below.

Target Data for Cable Sizing

Sized or Unsized

Unsized Power Cables Only

When this option is selected, power cables in the electrical load schedule where cable sizes are blank (including Error code) or #Wire/Phase is zero (0) become the targets for the sizing.

All Power Cables

When this option is selected, all power cables in the electrical load schedule become targets for the sizing. These will overwrite the existing sizes unless "Lock" option is specified on the electrical load schedule.

Cable Library

Use Available Cable Sizes Only

When this option is selected, only the cable sizes in the cable library where the field [Available] = Yes become available for the sizing.

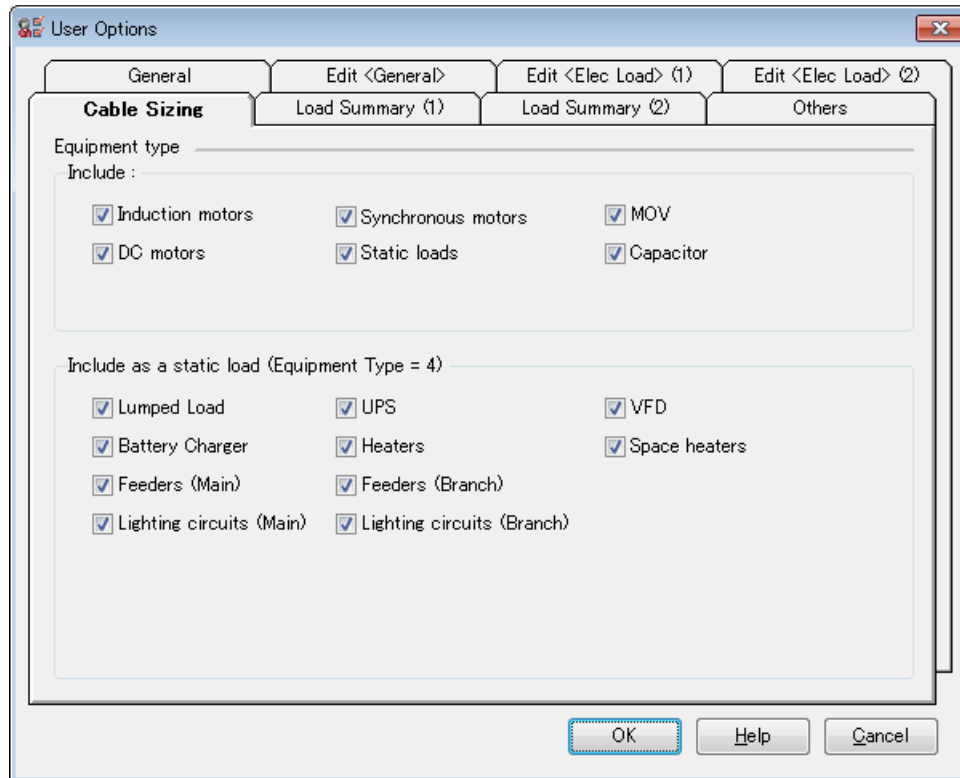
Use All Cable Sizes

When this option is selected, all the cable sizes in the cable library become available for the sizing.

Type of Electrical Equipment

Clicking "Details" button brings up "User Options" - "Cable Sizing" tab. Users could select equipment types to include in the cable sizing calculation.

The equipment types are specified in the menu "Edit" → category "All Elec. Loads" → some editor screens.



Type of Driven Loads

The target motors for cable sizing can be filtered by the type of their driven load. This option allows user to specify different sizing criteria such as the derating factors for different types of motors (according to driven load). For example, in the case of air fin coolers where normally no spare machines are provided in the air fin bays, their power cables carry current nearly to their designed ampacity limit.

Exclude Locked Items

Overwriting data for locked items is impossible on eDPP. However, this option is an exception. Cable sizing can be performed irrespective of the value of individual "Locked" flag.

When this check box remains checked, "Locked" records are excluded from the scope of cable sizing algorithm.

Cable Application

Overwrite Cable Voltage & Type

When this option is selected, cable voltages, cable types and no. of cores specified here will have priorities for the sizing. Existing cable sizes will be overwritten on the electrical load schedule.

Manufacturer

Select a manufacturer for the cable sizing data reference. The default value initially set is "DPP".

Frequency (Hz)

The power frequency from the menu "Project" → "Standard" is shown here.

Units

The units of cable dimensions selected in the menu "Project" → "Standard" is shown here.

Standard

The applied standard of cable selected in the menu "Project" → "Standard" is shown here.

Voltage Class**Run Sizing**

Select the desired voltage classes on which to perform the sizing.

Load kV

The motor rated voltages selected in the menu "Project" → "Electrical" are shown here.

Cable Voltage

The rated cable voltages defined in the menu "**Project**" → "**Electrical**" are shown. It is necessary to define the cable rated voltage prior to the sizing calculation if cable types on this GUI is to be selected.

U/G and A/G

Indicate the appropriate cable type and grouping factor to be used in the cable sizing for each voltage class and type of installation i.e. U/G and A/G

Cable Type

You can select cable type from the list box for each voltage class and each type of cable installation, A/G (Above ground) or U/G (Underground).

The correspondence with the raceway type is as follows;

U/G Duct	U/G	(Raceway Type = 0)
U/G Buried	U/G	(Raceway Type = 1)
A/G Trays	A/G	(Raceway Type = 2)
A/G Conduit	A/G	(Raceway Type = 3)
Air Drop	A/G	(Raceway Type = 4)

Temp Factor

The temperature derating factor is automatically displayed here. The calculation of this factor is described in "**Adjust by Ambient Temp. (deg.C) (Ta)**" above.

Group Factor

You can specify grouping factors in the range of 0.01 to 1.00 for each voltage class and each type of cable installation. The grouping factors reflect installation method of cable conductors, e.g. spacing, trefoil, parallel, trays, etc. e-DPP does not consider adjustment factors for differences in soil thermal resistivity or depth of buried cables, these factors may be included into the grouping factors for a practical solution.

Application MF

Specify the desired Application MF (Multiplying Factor) for motor and static load independently. The Application MF is used to derate the cable ampacity (MF times full load current).

13.1.2 Command Buttons

Run

After all the parameters are set above, click "Run" button to execute power cable sizing. If one or more cables were tagged for sizing, "Results" window appears as shown in the next page, Section 13.1.3.

Save

To save the parameters set above, click "Save" button.

Print

An image of this active window is pasted to Word Pad file. You can print the image showing all the parameters.

Help

Click on "Help" button to open On-Line help file.

Close

Click on "Close" button to close this dialog window of Cable Sizing Criteria.

13.1.3 Results

Lock	Load ID	Eq Type	Output	Unit	Pole	Voltage (kV)	Phase	FLC (A)	MF	FLC x MF (A)	PF (%) at FL	LRC (%)	PF (%) at LR	Inst	Cable ID	Cond Type	Cable Voltage	Cable Type	No of Cores	Size	#/P
1	AM-2001	IM	2200	kW	4	0.460	3	34.0	1.250	42.5	88.4	667	44.0	U/G B	AM-2001-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	25	1
2	BC-E104	STL	30.00	kVA	0	0.240	1	125.0	1.000	125.0	90.0	0	0.0	A/G T	BC-E104-P	Cu	0.6/1kV	XLPE/PVC	3/C	240	2
3	BM-1401	IM	30.00	kW	4	0.460	3	46.5	1.250	58.2	85.6	645	44.0	U/G B	BM-1401-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	35	1
4	CM-5703	IM	2.20	kW	4	0.460	3	4.0	1.250	5.0	83.2	609	66.0	U/G B	CM-5703-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	4	1
5	DM-1001A	IM	750	kW	4	0.460	3	12.6	1.250	15.8	84.1	638	57.0	U/G B	DM-1001A-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	10	1
6	DM-1001B	IM	750	kW	4	0.460	3	12.6	1.250	15.8	84.1	638	57.0	U/G B	DM-1001B-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	10	1
7	EF-2614	IM	0.20	kW	4	0.220	3	1.3	1.250	1.6	62.0	407	74.0	A/G T	EF-2614-P	Cu	0.6/1kV	XLPE/PVC	3/C	4	1
8	EF-2614	IM	0.40	kW	4	0.220	3	2.1	1.250	2.6	70.1	457	66.0	A/G T	EF-2614-P	Cu	0.6/1kV	XLPE/PVC	3/C	4	1
9	ELP-04A	STL	15.00	kVA	0	0.240	1	62.5	1.000	62.5	90.0	0	0.0	A/G T	ELP-04A-P	Cu	0.6/1kV	XLPE/PVC	3/C	240	1
10	ELP-04B	STL	15.00	kVA	0	0.240	1	62.5	1.000	62.5	90.0	0	0.0	A/G T	ELP-04B-P	Cu	0.6/1kV	XLPE/PVC	3/C	240	1
11	EM-2401A	IM	37.00	kW	4	0.460	3	56.5	1.250	70.7	88.2	615	46.0	U/G B	EM-2401A-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	35	1
12	EM-2401B	IM	37.00	kW	4	0.460	3	56.5	1.250	70.7	88.2	615	46.0	U/G B	EM-2401B-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	35	1
13	EM-2401C	IM	37.00	kW	4	0.460	3	56.5	1.250	70.7	88.2	615	46.0	U/G B	EM-2401C-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	35	1
14	EM-2401D	IM	37.00	kW	4	0.460	3	56.5	1.250	70.7	88.2	615	46.0	U/G B	EM-2401D-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	35	1
15	EM-2401E	IM	37.00	kW	4	0.460	3	56.5	1.250	70.7	88.2	615	46.0	U/G B	EM-2401E-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	35	1
16	EM-2401F	IM	37.00	kW	4	0.460	3	56.5	1.250	70.7	88.2	615	46.0	U/G B	EM-2401F-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	35	1
17	G-4002A-1AM	IM	15.00	kW	4	0.460	3	23.9	1.250	29.9	87.6	636	48.0	U/G B	G-4002A-1AM-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	16	1
18	G-4002B-1AM	IM	15.00	kW	4	0.460	3	23.9	1.250	29.9	87.6	636	48.0	U/G B	G-4002B-1AM-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	16	1
19	G-4002C-1AM	IM	15.00	kW	4	0.460	3	23.9	1.250	29.9	87.6	636	48.0	U/G B	G-4002C-1AM-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	16	1
20	GM-4002B	IM	2500.00	kW	4	13.200	3	412.3	1.000	412.3	90.0	630	20.0	U/G B	GM-4002B-P	Cu	3.6/6kV	XLPE/SWA/PVC	3/C	300	1
21	GM-4002B-SH	SH	0.25	kW	0	0.220	3	0.0	1.000	0.0	0.0	0	0.0	U/G D		Cu	0.6/1kV	XLPE/SWA/PVC	3/C	Err.1	0
22	GM-4002C	IM	2500.00	kW	4	13.200	3	412.3	1.000	412.3	90.0	630	20.0	U/G B	GM-4002C-P	Cu	3.6/6kV	XLPE/SWA/PVC	3/C	300	1
23	GM-4002C-SH	SH	0.25	kW	0	0.220	3	0.0	1.000	0.0	0.0	0	0.0	U/G D		Cu	0.6/1kV	XLPE/SWA/PVC	3/C	Err.1	0
24	GM-4002D	IM	2500.00	kW	4	13.200	3	412.3	1.000	412.3	90.0	630	20.0	U/G B	GM-4002D-P	Cu	3.6/6kV	XLPE/SWA/PVC	3/C	300	1
25	GM-4002D-SH	SH	0.25	kW	0	0.220	3	0.0	1.000	0.0	0.0	0	0.0	U/G D		Cu	0.6/1kV	XLPE/SWA/PVC	3/C	Err.1	0
26	GM-4002E	IM	2500.00	kW	4	13.200	3	412.3	1.000	412.3	90.0	630	20.0	U/G B	GM-4002E-P	Cu	3.6/6kV	XLPE/SWA/PVC	3/C	300	1
27	GM-4002E-SH	SH	0.25	kW	0	0.220	3	0.0	1.000	0.0	0.0	0	0.0	U/G D		Cu	0.6/1kV	XLPE/SWA/PVC	3/C	Err.1	0
28	H-4001	STL	85.00	kVA	0	0.480	1	177.1	1.000	177.1	90.0	0	0.0	U/G B	H-4001-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	400	1
29	LCP-DCS-01	STL	60.00	kVA	0	0.240	1	250.0	1.000	250.0	90.0	0	0.0	A/G T	LCP-DCS-01-P	Cu	0.6/1kV	XLPE/PVC	3/C	300	3
30	LCP-DCS-02	STL	40.00	kVA	0	0.240	1	166.7	1.000	166.7	90.0	0	0.0	A/G T	LCP-DCS-02-P	Cu	0.6/1kV	XLPE/PVC	3/C	300	2
31	LP-1502	STL	1.50	kVA	0	0.240	1	6.3	1.000	6.3	90.0	0	0.0	A/G T	LP-1502-P	Cu	0.6/1kV	XLPE/PVC	3/C	16	1
32	MM-1601A	IM	5.60	kW	4	0.460	3	9.6	1.250	12.0	80.7	636	58.0	U/G B	MM-1601A-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	10	1
33	MM-1601B	IM	5.60	kW	4	0.460	3	9.6	1.250	12.0	80.7	636	58.0	U/G B	MM-1601B-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	10	1
34	PM-1001A	IM	22.00	kW	4	0.460	3	33.9	1.250	42.4	88.4	667	44.0	U/G B	PM-1001A-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	25	1
35	PM-1001B	IM	22.00	kW	4	0.460	3	33.9	1.250	42.4	88.4	667	44.0	U/G B	PM-1001B-P	Cu	0.6/1kV	XLPE/SWA/PVC	3/C	25	1

<Dialog of Cable Sizing Results>

When "Run" button is clicked, the calculation of power cable sizing starts and the above window will be shown.

The cells filled with yellow color mean newly substituted values by the program.

The cells filled with blue color mean erroneous values (usually 0) that cause failure of the sizing. You need to correct those values in the editor and run the sizing program again.

Table of Sizing Results

This window indicates the results of cable sizing including;

Size

This column indicates calculated cable sizes. If the sizing fails and no cable size have been determined, error codes are filled in these cells instead of normal cable sizes.

Error Code	Reason of Sizing Failure
Err 1	Cable length is zero.
Err 2 1	System voltage is zero.
Err 2 2	Load voltage is zero.
Err 3 1	Motor locked rotor current is zero.
Err 3 2	Full load current is zero or negative.
Err 3 3	Power factor is zero.
Err 4 1	Cable resistance is zero.
Err 4 2	Cable reactance is zero.
Err 5	Cable ampacity data in the library are empty.
Err 6	Number of wires per phase exceeded 9

#/Ph

This column indicates the number of parallel conductors per phase (Max. 9). If this figure exceeds 9, the program terminates the sizing calculation and goes to the next electrical load. (Error code: "Err_6")

Length (m)

Length of cable in meter entered in the electrical load schedule.

Resistance (Ohm/km)

Resistance value of cable in ohms per one kilometer retrieved from the cable library. If #/Ph is more than 1, the value is divided by #/Ph value.

Reactance (Ohm/km)

Reactance value of cable in ohms per one kilometer retrieved from the cable library. If #/Ph is more than 1, the value is divided by #/Ph value.

Nominal Ampacity

Ampacity of the cable in ampere (base ampacity) before any adjustment (no de-rating factors is applied) retrieved from the cable library.

Temp Adj Factor

Derating factors for cable ampacity due to difference between base temperature on which cable is rated and the ambient temperature where the cable will be laid.

Group Factor

Derating factor for cable ampacity due to the grouping effect of cable installation in raceway. This factor is manually determined outside of e-DPP.

Derating Factor

Overall derating factor (Grouping factor * Temperature factor)

Derated Ampacity

Calculated cable ampacity multiplied by the overall derating factors.

%VD at Running

Calculated voltage drop (%) for the selected cable size at normal running condition.

Max. Length Run (m)

Maximum allowable length (m) of the selected cable size at normal operation

%VD at Starting

Calculated voltage drop (%) for the selected cable size at motor starting.

Max. Length Start (m)

Maximum allowable length (m) of the selected cable size at motor starting

FLA/Temp Amp

Ratio of the full load current of the connected load and the de-rated cable ampacity due to the "Temp Adj Factor" only ("Group Factor" not included).

Min. Size

If "**Apply Default Minimum Cable Sizes**" is selected, the minimum cable sizes for individual rated motors are retrieved from the minimum cable size table. This option is applicable for motors only (not for static loads).

Final Select Size

Select any cable size from the drop down list to alter the calculated size. This size will serve as the final size of the cable under consideration. If "Final Select Size" is not explicitly specified, the calculated size will take the precedence.

When selecting a new size different from the calculated one, a "Go" button will be shown in the adjacent column "Re-Calc". Clicking this button will result to a new set of calculated values based on the specified size. Parameters modified due to these results will be indicated in pink color.

(Note: An alert message will appear when the selected cable size from the drop down list is less than the calculated value, "Selected size is smaller than the calculated one! Changing the size will result in non-conformance with the sizing criteria".)

Key Factor

The number indicating key factors by which criteria the cable sizes have been determined are shown in this column.

- Key Factor = 1: By Ampacity
- Key Factor = 2: By Voltage drop at normal running
- Key Factor = 3: By Voltage drop at motor start
- Key Factor = 4: By Minimum Cable Size
- Key Factor = 5: By User Selection

Re-Calc

A "Go" button will be displayed to indicate that a new size (different from the calculated value) was selected from the "Final Selected Size" column. Refer to "Final Selected Size" above.

Derated Ampacity	% Vd at Running	Max Length Run (m)	% Vd at Starting	Max Length Start (m)	FLA / Temp Amp	Min. Size	Final Select Size	Key Factor	Re-Calc	Calc Size
164.0	1.51	843	5.85	667	0.16	16	50	5		50
117.5	1.98	61	0.00	0	0.49			2		35
136.0	3.75	482	14.81	367	0.27	25		3		35
48.8	2.84	254	14.41	150	0.13			3		6
48.8	2.79	332	10.66	262	0.22	6	10	4	Go	6
48.8	2.82	332	10.77	262	0.22	6		4		6
24.3	1.68	984	8.67	595	0.04		2.5	1		2.5
31.9	1.76	848	10.47	442	0.04		4	3		4
55.4	1.94	36	0.00	0	0.52		6	2		10
73.8	1.34	57	0.00	0	0.39		16	2		16
136.0	1.98	391	7.70	307	0.33	35		4		35

Note 1: It is not allowed to alter the calculated value of #/Ph. Even when you change the size, the recalculation will be carried out based on the indicated #/Ph value.

Note 2: Even if you don't carry out the recalculation, the selected size in the column "Final Selected Size", if any, will designate the final size of the cable.

Lock All/Unlock All

Locking or unlocking of all the records in a single click is possible with this option. In this way, records will be secured from overwriting.

Sizing Filter

In this option, calculated cable results will be filtered to show "all", "sized", or "unsized" items.

All

All the cables are shown regardless of sizing results.

Sized

Only cables with succeeded sizing results will be shown.

Unsize

Only cables for which the sizing failed and have the error codes (Err_***) will be shown.

Select Filter

You can filter the spread window with a field value of column where the cursor is currently located.

Filter

Only records that have the same cell value in a column where the cursor is located will be shown.

Remove

Reset the selected filter to show all the records.

Multi-Sort (+ Load ID)

You can sort the spread data with the following 6 option buttons;

None

Sorted by Load ID in an ascending order.

kV

Sorted by Load rated voltage in a descending order and Load ID in an ascending order.

Eq Type

Sorted by Equipment code and Load ID both in an ascending order.

Type/kV

Sorted by Equipment code (ascending), Load rated voltage (descending) and Load ID in an ascending order.

Cab Spec

Sorted by Cable voltage, Cable type, No. of cores and Load ID all in an ascending order.

Inst.

Sorted by raceway type and Load ID both in an ascending order.

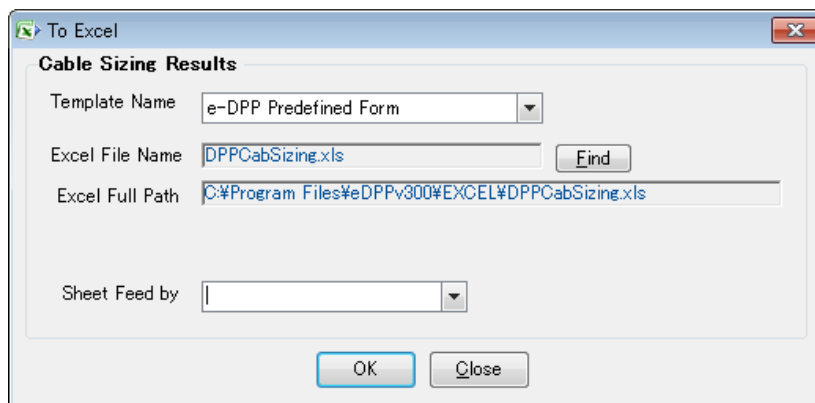
(Note: Clicking the column headers can also sort the spread window. Subsequent clicks toggle ascending and descending orders.)

Command**Save**

Click this button to save the sizing results shown in this window. However, if "Lock" protection is set "ON" in the electrical load schedule, new calculated cable sizes will not be overwritten.

To Excel

The sizing results can be exported to e-DPP predefined or user-defined Excel form. After clicking this button, another dialog box will be shown where in the user can specify items (form to be used, page feed condition, etc.) as desired.



The screenshot shows a dialog box titled "To Excel" with a close button (X) in the top right corner. The dialog is titled "Cable Sizing Results" and contains the following fields and controls:

- Template Name:** A dropdown menu currently showing "e-DPP Predefined Form".
- Excel File Name:** A text input field containing "DPPCabSizing.xls" and a "Find" button to the right.
- Excel Full Path:** A text input field containing "C:\Program Files\#eDPPv300\EXCEL#\DPPCabSizing.xls".
- Sheet Feed by:** A dropdown menu that is currently empty.

At the bottom of the dialog, there are two buttons: "OK" and "Close".

"Template Name"

Select any form from the pull down list to which the cable sizing results will be exported. A predefined user form can be defined in the menu "Template" → "Cable Sizing Result".

"Excel File Name"

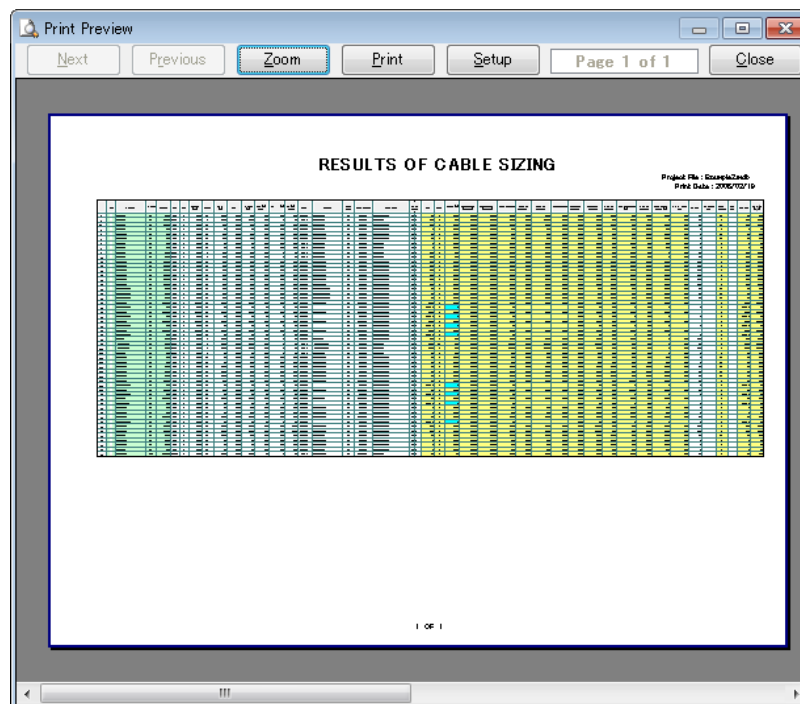
A different Excel template can be defined. However, changing it might cause mismatches in cell addresses against the selected template.

"Sheet Feed by"

This option allows user to define a base field (kV, System kV, MotVoltageClass, etc.) where the output should be categorized as sheets in excel.

Preview

Click on "Preview" button to show printable layout of the generated cable sizing result.

Preview Toolbar**"Next"**

Click on "Next" button to navigate the next page (grayed-out if the preview contains only one page or if the preview is on the last page).

"Previous"

Click on "Previous" button to navigate to previous page (grayed-out if the preview contains only one page or if the preview is on the first page).

"Zoom"

Click on "Zoom" button to zoom-in or out the preview layout.

"Print"

Click on "Print" button to bring up the Print dialog box to start and print job.

(Note: Print setup is also accessible in this menu.)

"Setup"

Click on "Setup" button to display the Setup dialog box, which contains options that allows user to define printing preferences.

"Close"

Click on "Close" button to close and return to Cable Sizing result Dialog.

Help

Click on "Help" button to open On-Line help file.

Close

Click on "Close" button to save (apply the result of the cable sizing) and return to the dialog of Cable Sizing Criteria.

13.1.4 Calculation Formulas

The criteria of power cable sizing implemented in e-DPP are expressed by the following three categories;

- (1) Derated cable ampacity vs. load current
- (2) Voltage drop (%) at normal load operation
- (3) Voltage drop (%) at motor start (For motor loads only)

The detailed procedures and formulas for power cable sizing are described below.

13.1.4.1 Cable Ampacities

"Temperature Factor"

When "Adjust by Ambient Temp. (Ta)" is selected on the entrance menu, the temperature factor **Fta** is calculated with the approximation formula for each installation method ("U/G" or "A/G") by the difference between the base and actual ambient temperatures of cable installation;

$$Fta = \sqrt{\frac{Tc - T}{Tc - Ta}}$$

Where

Tc: Maximum conductor temperature

Ta: Base ambient temperature

T : Actual ambient temperature

The result of calculated **Fta** is referred by the cable sizing calculation and reflected to the overall "Derating Factor".

If this option is not selected, the default value 1.00 is substituted in **Fta**.

"Grouping Factor"

You can input grouping factor **Fg** for each cable installation type on the entrance menu. The product of **Fg** and **Fta** becomes an overall derating factor.

"Comparison with Load Current"

The derated cable ampacity is compared with a load current multiplied by "Application MF" that can be inputted on the entrance menu.

$$[\text{Cable Ampacity}] * F_{ta} * F_g > [\text{Application MF}] * [\text{Load Current}]$$

If the above condition becomes true, then the program goes to the next step to calculate a voltage drop. If false, the next larger size of cable in the cable library will be examined.

13.1.4.2 Unit Adjustment for R & X

Prior to the voltage drop calculations, the program converts cable resistances and reactances into the unit of "ohm per 1 km" since the cable library may include several units for cable length.

13.1.4.3 Voltage Drop at Normal Operation**Maximum Cable Length at a Given Voltage Drop at Normal Operation**

The calculation formula for the maximum length of cable against the specified voltage drop at normal running varies depending on the types of loads as follows.

(1) 3-phase Motor

$$l(m) = \frac{10000 \times \varepsilon \times V_s}{\sqrt{3} \times I \times (r \cos \theta + x \sin \theta)}$$

Where

$l(m)$:	Maximum cable length (m)
ε (%):	Specified voltage drop (%)
V_s (kV):	System (bus) voltage (kV)
I (A)	Motor full load current (A)
r (ohm/km):	Resistance of cable (ohm/km)
x (ohm/km):	Reactance of cable (ohm/km)
$\cos \theta$:	Motor power factor at full load
$\sin \theta$:	Motor reactance factor at full load

(2) 1-phase Motor

$$l(m) = \frac{10000 \times \varepsilon \times V_s}{2 \times I \times (r \cos \theta + x \sin \theta)}$$

(3) 3-phase Static Load (incl. Capacitor, UPS, Feeder, Lighting Circuit, VFD, Battery Charger, Heater, Space Heater and Lumped Load)

The calculation formula for the maximum cable length is given below by using KVA of a static load.

$$l(m) = \frac{10000 \times \varepsilon \times V_s^2}{KVA \times (r \cos \theta + x \sin \theta)}$$

Where

$l(m)$:	Maximum cable length (m)
ε (%) :	Specified voltage drop (%)
V_s (kV):	System (bus) voltage (kV)
r (ohm/km):	Resistance of cable (ohm/km)
x (ohm/km):	Reactance of cable (ohm/km)
$\cos \theta$:	Power factor of static load at full load
$\sin \theta$:	Reactance factor of static load at full load

(4) 1-phase Static Load

$$l(m) = \frac{5000 \times \varepsilon \times V_s^2}{KVA \times (r \cos \theta + x \sin \theta)}$$

(5) DC Motor

$$l(m) = \frac{10000 \times \varepsilon \times V_s}{2 \times I \times r}$$

If the calculated $l(m)$ is greater than or equal to the length of load cable, the program goes to the next step to calculate a voltage drop at motor start.

If not, the next larger size of cable in the cable library will be examined.

Voltage Drop at a Given Cable Length at Normal Operation

The formulas for voltage drop (%) at normal operation are as follows;

(1) 3-phase Motor

$$\varepsilon(\%) = \frac{\sqrt{3} \times I \times (rl \cos \theta + xl \sin \theta)}{10000 \times V_s}$$

where

ε (%) :	Calculated voltage drop (%) by the selected cable size
l (m):	Actual cable length (m) of load
V_s (kV):	System (bus) voltage (kV)
I (A):	Motor full load current (A)
r (ohm/km):	Resistance (ohm/km) of the selected cable size
x (ohm/km):	Reactance (ohm/km) of the selected cable size
$\cos \theta$:	Motor power factor at full load
$\sin \theta$:	Motor reactance factor at full load

(2) 1-phase Motor

$$\varepsilon(\%) = \frac{2 \times I \times (rl \cos \theta + xl \sin \theta)}{10000 \times V_s}$$

(3) 3-phase Static Load

$$\varepsilon(\%) = \frac{KVA \times (rl \cos \theta + xl \sin \theta)}{10000 \times V_s^2}$$

Where

- ε (%): Calculated voltage drop (%) by the selected cable size
- KVA: Capacity of static load (kVA)
- l (m): Actual cable length (m) of load
- V_s (kV): System (bus) voltage (kV)
- r (ohm/km): Resistance (ohm/km) of the selected cable size
- x (ohm/km): Reactance (ohm/km) of the selected cable size
- $\cos \theta$: Power factor of static load at full load
- $\sin \theta$: Reactance factor of static load at full load

(4) 1-phase Static Load

$$\varepsilon(\%) = \frac{KVA \times (rl \cos \theta + xl \sin \theta)}{5000 \times V_s^2}$$

(5) DC Motor

$$\varepsilon(\%) = \frac{I \times r \times l}{5000 \times V_s}$$

13.1.4.4 Voltage Drop at Motor Start

Maximum Cable Length at a Given Voltage Drop at Motor Start

The maximum cable length against the specified voltage drop (%) is calculated with the formula;

$$l_s(m) = 1000 \times \frac{- (rR + xX) + \sqrt{(rR + xX)^2 - (r^2 + x^2) \left\{ R^2 + X^2 - \left(\frac{Z}{1 - \frac{\varepsilon_s}{100}} \right)^2 \right\}}}{r^2 + x^2}$$

Where

- l_s (m): Maximum cable length (m)
- ε_s (%): Specified voltage drop (%)
- r (ohm/km): Resistance of cable (ohm/km)
- x (ohm/km): Reactance of cable (ohm/km)
- Z (ohm): Motor impedance at starting

<[PhaseNo]="3">

$$Z = \frac{100000 \times V_m}{\sqrt{3} \times I_s \times I}$$

<[PhaseNo]="1" or "DC">

$$Z = \frac{100000 \times V_m}{I_s \times I}$$

V_m (kV):	Motor rated voltage (kV)
I (A)	Motor full load current (A)
I_s (%)	Motor locked rotor current (%) of I
R (ohm):	Motor resistance at starting
	$R = Z \times \cos \theta_s$
X (ohm):	Motor reactance at starting
	$X = Z \times \sin \theta_s$
$\cos \theta_s$:	Motor power factor at starting
$\sin \theta_s$:	Motor reactance factor at starting

If the calculated l (m) is greater than or equal to the length of load cable, this cable size will be taken as a calculation result.

If not, the next larger size of cable in the cable library will be examined.

Voltage Drop at a Given Cable Length at Motor Start

The formula for voltage drop (%) at motor start is;

$$\varepsilon_s(\%) = \left\{ 1 - \frac{Z}{\sqrt{\left(R + \frac{rl}{1000}\right)^2 + \left(X + \frac{xl}{1000}\right)^2}} \right\} \times 100$$

Where

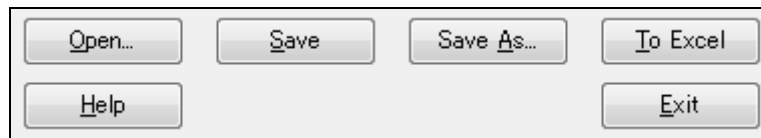
ε_s (%):	Calculated voltage drop (%) by the selected cable size
l (m):	Actual cable length (m) of load
r (ohm/km):	Resistance (ohm/km) of the selected cable size
x (ohm/km):	Reactance (ohm/km) of the selected cable size
Z (ohm):	Motor impedance at starting
R (ohm):	Motor resistance at starting
X (ohm):	Motor reactance at starting

13.2 Cable Sizing Chart

The program of "Cable Sizing Chart" generates a selection table for power cable sizes. The calculation formulas used in the program are the same as those for Power Cable Sizing described in **Chapter 13.1** and based on allowable cable ampacity, voltage drop ratios at normal operation of load and motor starting.

The databases referred to by the program, i.e. motor, cable and static load, have the same structures as those of e-DPP and hence, editable with e-DPP library menu.

13.2.1 Command Buttons



Open

All the parameters set in 5 pages (see 16.1.2 to 16.1.6) are stored in Parameter file with the file extension **.prm**. Click on "Open" button to select an existing parameter file. The program loads the stored parameters into 5 pages.

Save

Click on "Save" button to save modified or newly defined parameters in the same file name.

Save As

Click on "Save As" button to save modified or newly defined parameters in a different name of file.

To Excel

Click on "To Excel" button to generate a cable sizing chart with the parameters defined in 5 pages. MS-Excel automatically launches and indicates a chart sheet. Use the Save As menu command of MS Excel when saving the Excel sheet with a different file name. The default name of generated Excel sheet is "DPPCabChart.xls".

Help

Click on "Help" button to open On-Line help file.

Exit

Click on "Exit" button to terminate the cable sizing chart program (not e-DPP program).

13.2.2 General Page

Project information you entered in this page appears in the header and/or footer parts of Cable Sizing Chart (MS Excel sheet).

The screenshot shows a dialog box titled "Cable Sizing Chart - Example-Motor" with a close button (X) in the top right corner. The dialog has five tabs: "General", "Criteria", "Load/Motor", "Cable", and "Others". The "General" tab is selected and contains the following fields and options:

- Project Information**
 - Customer : ABC Engineering Company
 - Project Title : Electrical Data Processing
 - Job No. : JB-01234
 - Doc No. : Example Motor 3phase-3wire
 - Date : 2008-01-01
 - Rev. No. : A
- MS Excel Form**
 - e-DPP Predefined Form
 - User Defined Form
 - A dropdown menu showing "eDPP Cable Sizing Chart (New) - Motor"

At the bottom of the dialog, there are seven buttons: "Open...", "Save", "Save As...", "To Excel", "Help", and "Exit".

Project Information

Customer

Name of customer is up to 50 alphanumeric characters. This data is retrieved from Project Information (See Chapter 8.1) and not editable by user.

Project Title

Project title is up to 30 alphanumeric characters. This data is retrieved from Project Information (See Chapter 8.1) and not editable by user.

Job No.

Job number is up to 20 alphanumeric characters. This data is retrieved from Project Information (See Chapter 8.1) and not editable by user.

Document No.

Enter any alphanumeric characters for user document no.

Date

Enter any alphanumeric characters for execution, saving or print date.

Rev. No.

Enter any alphanumeric characters for revision no. of chart

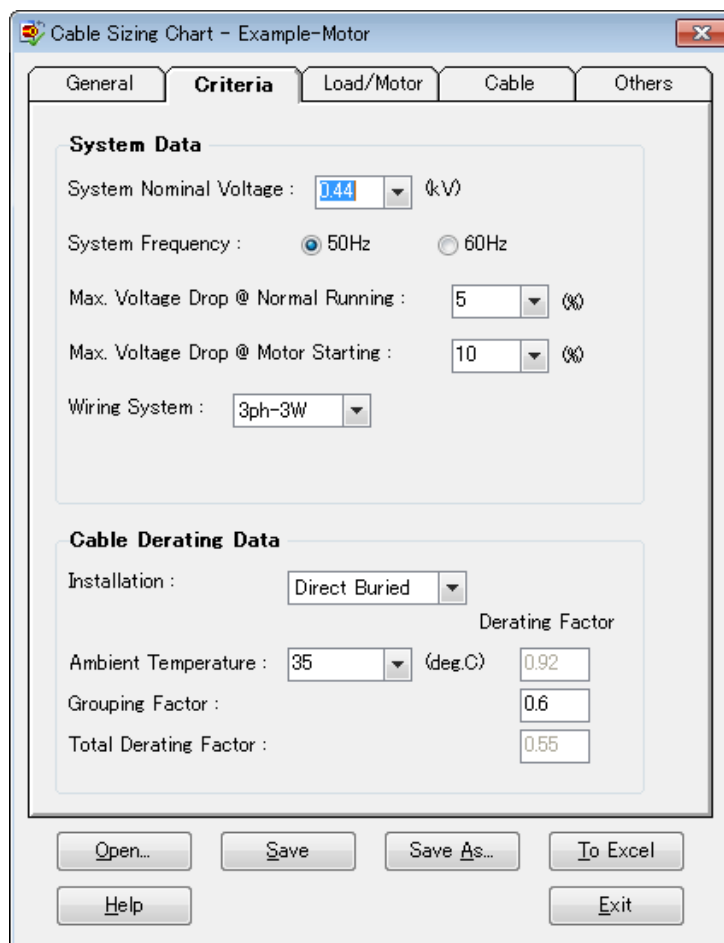
Note: When using 0 (zero) for the revision no. and the setting of "Zero values" is unchecked in MS-Excel Tools → Options → View, 0 (zero) will not be shown in MS-Excel sheet. In this case, please enter '0 (single quotation mark + zero) in this Rev. No. cell.

MS Excel Form

You can select the output form either "e-DPP Predefined Form" or "User Defined Form". If you click "User Defined Form" option, the pull down list becomes enabled and you can select any of user defined forms that you have customized in the menu "Template" → "Cable Sizing Chart...".

13.2.3 Criteria Page

Criteria you defined in this page is used by the calculation formulas of maximum cable length.



System Data

System Nominal Voltage (kV)

Select or enter nominal voltage of bus supplying motor/load in kilo-volt. Generally, this voltage is different from motor/load rated voltage.

System Frequency

Select either 50Hz or 60Hz.

Max. Voltage Drop @ Normal Running (%)

Select or enter allowable maximum voltage drop in % against a system voltage at normal running. Typical value is 3-5% for motors and 1-5% for static loads.

Max. Voltage Drop @ Motor Starting (%)

Select or enter allowable maximum voltage drop in % against a system voltage at motor starting. Typical value is 15-20%. This option is disabled when static load type is selected in "Load Type" of Load/Motor Page.

Wiring System

Select the numbers of phases and wires for applied circuit system.

Cable Derating Data**Installation**

Select raceway type of power cable from Duct Bank, Direct Buried, Free Air and Conduit Air. The program obtains ampacity data from the cable library according to this selection.

Ambient Temperature (deg. C)

Select or enter ambient temperature of cable. The program calculates a compensation factor F_{ta} in comparison with the base ambient temperature stored in the reference database, and indicates in the "Derating Factor" cell.

The calculation formula is given below.

$$F_{ta} = \sqrt{\frac{T_c - T}{T_c - T_a}}$$

Where

T_c: Maximum conductor temperature

T_a: Base ambient temperature

T : Actual ambient temperature

T_c and T_a are stored in the cable library. T is entered by user.

Grouping Factor

You can specify grouping factors in the range of 0.01 to 1.00. The grouping factors reflect installation method of cable conductors, e.g. spacing, trefoil, parallel, trays, etc. e-DPP does not consider adjustment factors for differences in soil thermal resistivity or depth of buried cables, these factors may be included into the grouping factors for a practical solution.

Total Derating Factor

e-DPP automatically calculates the total derating factor as a product of the compensation factor of ambient temperature and the grouping factor.

$$\text{Total Derating Factor} = F_{ta} * \text{Grouping Factor}$$

13.2.4 Load/Motor Page

The screenshot shows the 'Cable Sizing Chart - Example-Motor' dialog box with the 'Load/Motor' tab selected. The dialog has five tabs: General, Criteria, Load/Motor, Cable, and Others. The 'Load/Motor' tab contains the following elements:

- A 'Select Library File...' button with a text box below it containing the path: C:\Program Files\eDPPv300\Example\LibExample.mdb
- Load Type** section with radio buttons for 'Motor' (selected) and 'Static Load'.
- Load Specification** section with the following controls:
 - Output Unit: Radio buttons for 'KW' (selected) and 'HP'.
 - Number of Phase: A dropdown menu set to '3'.
 - Manufacturer: A dropdown menu set to 'DPP'.
 - Rated Voltage: A dropdown menu set to '0.4'.
 - Enclosure Type: A dropdown menu set to 'TEFC'.
 - Number of Poles: A dropdown menu set to '4'.
- Two buttons at the bottom: 'Edit Motor Library' and 'Edit Static Load Library'.

At the bottom of the dialog box, there are two rows of buttons: 'Open...', 'Save', 'Save As...', 'To Excel' in the first row, and 'Help', 'Exit' in the second row.

"Select Library File" Button

Click on this button and select a new file on the dialog to change the reference library.

Load Type

Select either Motor or Static Load. When Static Load is selected, the criterion of voltage drop % at motor starting is not applied.

Load Specification

Output Unit

Select either KW or HP. The load output values are indicated in the selected unit on the chart.

Number of Phase

Select either 3 or 1 (single). The calculation formulas of cable voltage drop vary on the selected number of phase.

Manufacturer

Select a name of manufacturer from the pull down list. The selected manufacturer is used as a key field to retrieve the data from static load or motor library.

Rated Voltage

Select a rated voltage of static load or motor from the pull down list. The selected rated voltage is used as a key field to retrieve the data from static load or motor library.

Enclosure Type

Select a type of enclosure for motors from the pull down list. The selected type is used as a key field to retrieve the data from motor library. When Static Load is selected, this selection list is disabled.

Number of Poles

Select the number of poles for motors from the pull down list. The selected figure is used as a key field to retrieve the data from motor library. When Static Load is selected, this selection list is disabled.

"Edit Motor Library" Button

To change the motor library data in the selected library file, click on this button and go to the motor library menu. Changes made through this button also permanently affect the library data.

"Edit Static Load Library" Button

To change the static load library data in the selected library file, click on this button and go to the static load library menu. Changes made through this button also permanently affect the library data.

13.2.5 Cable Page

The screenshot shows a software dialog box titled "Cable Sizing Chart - Example-Motor" with a close button (X) in the top right corner. The dialog has five tabs: "General", "Criteria", "Load/Motor", "Cable", and "Others". The "Cable" tab is selected and active. It contains two main sections: "Cable Specification" and "Temperature Data".

Cable Specification

- Standard: IEC (dropdown menu)
- Unit System: Metric, English
- Manufacturer: DPP (dropdown menu)
- Conduit Installation: Magnetic, Non-Mag
- Conductor Type: Cu, Al
- Rated Voltage: 0.6/1kV (dropdown menu)
- Insulation Type: XLPE/SWA/PVC (dropdown menu)
- Number of Cores: 3 (dropdown menu)
- Type of Cores: C (dropdown menu)

Temperature Data

- Base Temperature (A/G): 40 (text box) (deg.C)
- Base Temperature (U/G): 25 (text box) (deg.C)
- Max Conductor Temp: 90 (text box) (deg.C)

Below the "Temperature Data" section is an "Edit Cable Library" button. At the bottom of the dialog are several control buttons: "Open...", "Save", "Save As...", "To Excel", "Help", and "Exit".

Cable Specification

Standard

Select an applicable standard of cable from the pull down list. The selected standard is used as a key field to retrieve the data from cable library.

Unit System

Select either Metric (mm²) or English (AWG, kcmil, MCM). The selected unit system is used as a key field to retrieve the data from cable library.

Manufacturer

Select a name of manufacturer from the pull down list. The selected manufacturer is used as a key field to retrieve the data from cable library.

Conduit Installation

Not selectable. Only Non-Mag option is available.

Conductor Type

Select either Co (Copper) or Al (Aluminum) for cable conductor type.

Rated Voltage

Select a rated voltage of cable from the pull down list. The selected voltage is used as a key field to retrieve the data from cable library.

Insulation Type

Select an insulation type of cable from the pull down list. The selected type is used as a key field to retrieve the data from cable library.

Number of Cores

Select the number of cable cores from the pull down list. The selected number is used as a key field to retrieve the data from cable library.

Type of Cores

Select a type of cable cores from the pull down list. The selected type is used as a key field to retrieve the data from cable library.

"C" stands for Core, "P" for Pair, "T" for Triplex or Triad, etc.

Temperature Data**Base Temperature (A/G) (deg. C)**

Retrieved data from the referenced library for base temperature (above ground) is indicated in this cell and not editable by user.

Base Temperature (U/G) (deg. C)

Retrieved data from the referenced library for base temperature (underground) is indicated in this cell and not editable by user.

Max. Conductor Temp (deg. C)

Retrieved data from the referenced library for maximum conductor temperature is indicated in this cell and not editable by user.

"Edit Cable Library" Button

When you like to change the cable library data in the selected library file, click on this button and go to the cable library menu. Changes made through this button also permanently affect the library data.

13.2.6 Others Page

Other Settings

Max. Cable Length to Show (m)

Specifying the maximum length here, the calculation results of allowable cable length that exceed the specified figure are not shown in the cable sizing chart (MS-Excel sheet).

Multiplying Factor (MF)

To adopt multiplying factors to the full load currents of static loads or motors, you can specify 2 figures with a boundary of current value.

The factors affect only cable ampacity calculation but not voltage drops. See **Chapter 13.2.7 "Calculation Formulas"**

Number of Parallel Cables

In addition to the chart for single run cable (default), other charts for parallel cables can be generated.

"1", "2", "3", "4" & "5" Checkboxes

Check any boxes of number "2" to "4" when you want to create additional cable sizing charts for parallel runs. The number "1", "2", "3", "4" & "5" mean the number of parallel cables. The checkbox "1" is always checked as default.

Additional charts for parallel cables will be created in new sheets of the same MS Excel book with the

sheet name "Parallel 2", "Parallel 3" and so on.

Minimum Cable Size of Parallel Runs

Usually the minimum cable sizes for parallel runs are different from (larger than) the ones for single run cables. Select the minimum size from the pull down list for parallel runs. The columns of cable data of which the sizes are less than the selected minimum size are not shown in created charts.

Minimum Cable Sizes

Use this option to reflect the minimum cable sizes specified in the menu "Cable Management" → "Minimum Cable Size...". This option is applicable to motors only.

Apply

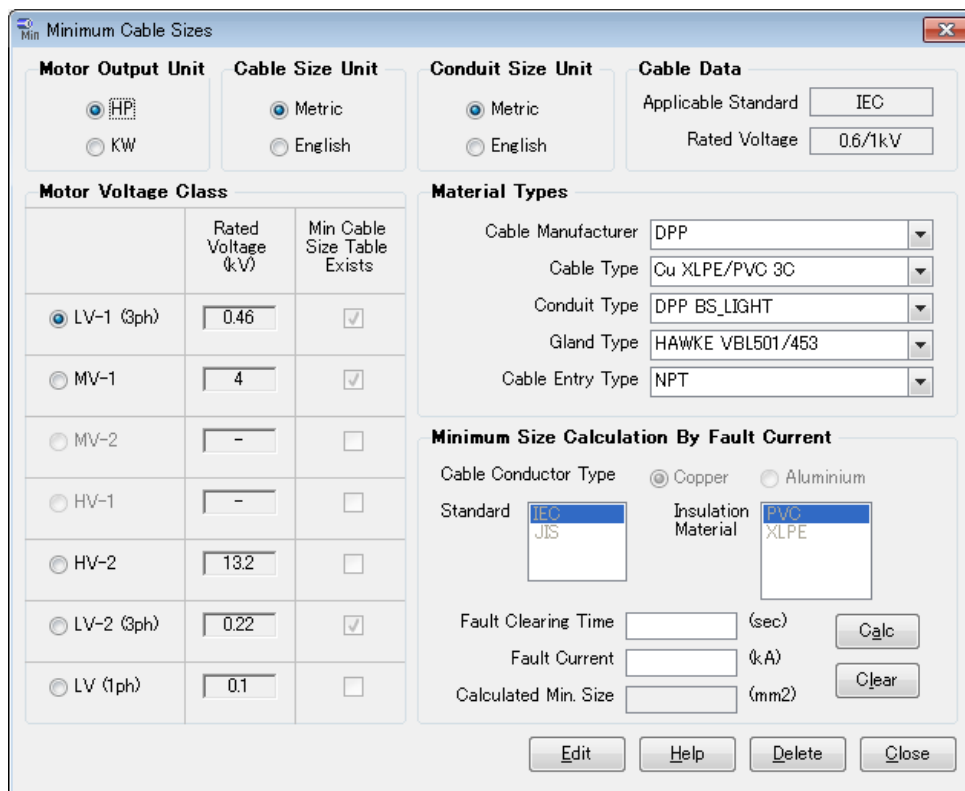
The minimum cable sizes are taken into account when creating the charts.

Ignore

The minimum cable sizes are not taken into account when creating the charts.

"Show Min. Cable Size" Button

To define or edit the minimum cable sizes for motor loads, click "Show Min. Cable Size" button. "Minimum Cable Sizes" dialog box appears.



<Dialog of Minimum Cable Sizes>

Length Cell of Min. Size

This option determines the color of intersectional cell of the minimum size of cable data column and motor data row.

- Default** : Default background color does not change.
- Yellow Color** : Background color changes to yellow.

Length Cell under Min. Size

This option determines the presentation of cell in which cable sizes are less than the minimum cable sizes.

- Blank** : Calculated maximum cable lengths are not shown.
- Gray Color** : Background color changes to gray. Calculated lengths remains in cells.

731					
372	596	888			
199	319	474	791		
137	219	326	544	848	
99	158	235	391	608	
60	97	144	240	373	
46	74	110	183	285	
	58	87	144	224	
			109	169	
			104	161	
				120	

<Coloring of Minimum Cable Size Options>

13.2.7 Calculation Formulas

The criteria of power cable sizing implemented in e-DPP are expressed by the following three categories;

- (1) Derated cable ampacity vs. load current
- (2) Voltage drop (%) at normal load operation
- (3) Voltage drop (%) at motor start (For motor loads only)

The detailed procedures and formulas for power cable sizing are described below.

13.2.7.1 Cable Ampacities

"Temperature Factor"

The temperature factor **Fta** is calculated with the approximation formula for each installation method ("U/G" or "A/G") by the difference between the base and actual ambient temperatures of cable installation;

$$Fta = \sqrt{\frac{Tc - T}{Tc - Ta}}$$

Where

- Tc: Maximum conductor temperature
- Ta: Base ambient temperature
- T : Actual ambient temperature

The result of calculated **F_{ta}** is referred by the cable sizing calculation and reflected to the overall "Derating Factor".

"Grouping Factor"

You can input grouping factor **F_g** for each cable installation type on the Criteria Page. The product of **F_g** and **F_{ta}** becomes an overall derating factor.

"Comparison with Load Current"

The derated cable ampacity is compared with a load current multiplied by "Multiplying Factor MF" that can be inputted on the Other Page.

$$[\text{Cable Ampacity}] * \mathbf{F_{ta}} * \mathbf{F_g} > [\text{Multiplying Factor (MF)}] * [\text{Load Current}]$$

If the above condition becomes true, then the program goes to the next step to calculate a voltage drop. If false, the next larger size of cable in the cable library will be examined.

13.2.7.2 Voltage Drop at Normal Operation

The calculation formula for the maximum length of cable against the specified voltage drop at normal running varies depending on the types of loads as follows.

(1) 3-phase Motor

$$l(m) = \frac{10000 \times \varepsilon \times V_s}{\sqrt{3} \times I \times (r \cos \theta + x \sin \theta)}$$

Where

$l(m)$:	Maximum cable length (m)
ε (%) :	Specified voltage drop (%)
V_s (kV):	System (bus) voltage (kV)
I (A)	Motor full load current (A)
r (ohm/km):	Resistance of cable (ohm/km)
x (ohm/km):	Reactance of cable (ohm/km)
$\cos \theta$:	Motor power factor at full load
$\sin \theta$:	Motor reactance factor at full load

(2) 1-phase Motor

$$l(m) = \frac{10000 \times \varepsilon \times V_s}{2 \times I \times (r \cos \theta + x \sin \theta)}$$

(3) 3-phase Static Load

The calculation formula for the maximum cable length is given below by using KVA of a static load.

$$l(m) = \frac{10000 \times \varepsilon \times V_s^2}{KVA \times (r \cos \theta + x \sin \theta)}$$

Where

- $l(m)$: Maximum cable length (m)
- ε (%): Specified voltage drop (%)
- V_s (kV): System (bus) voltage (kV)
- r (ohm/km): Resistance of cable (ohm/km)
- x (ohm/km): Reactance of cable (ohm/km)
- $\cos \theta$: Power factor of static load at full load
- $\sin \theta$: Reactance factor of static load at full load

(4) 1-phase Static Load

$$l(m) = \frac{5000 \times \varepsilon \times V_s^2}{KVA \times (r \cos \theta + x \sin \theta)}$$

If the calculated $l(m)$ is greater than or equal to the length of load cable, the program goes to the next step to calculate a voltage drop at motor start.
 If not, the next larger size of cable in the cable library will be examined.

13.2.7.3 Voltage Drop at Motor Start

The maximum cable length against the specified voltage drop (%) is calculated with the formula;

$$l_s(m) = 1000 \times \frac{- (rR + xX) + \sqrt{(rR + xX)^2 - (r^2 + x^2) \left[R^2 + X^2 - \left(\frac{Z}{1 - \frac{\varepsilon_s}{100}} \right)^2 \right]}}{r^2 + x^2}$$

Where

- $l_s(m)$: Maximum cable length (m)
- ε_s (%): Specified voltage drop (%)
- r (ohm/km): Resistance of cable (ohm/km)
- x (ohm/km): Reactance of cable (ohm/km)
- Z (ohm): Motor impedance at starting

<[PhaseNo]="3">

$$Z = \frac{100000 \times V_m}{\sqrt{3} \times I_s \times I}$$

<[PhaseNo]="1" or "DC">

$$Z = \frac{100000 \times V_m}{I_s \times I}$$

V_m (kV):	Motor rated voltage (kV)
I (A)	Motor full load current (A)
I_s (%)	Motor locked rotor current (%) of I
R (ohm):	Motor resistance at starting $R = Z \times \cos \theta_s$
X (ohm):	Motor reactance at starting $X = Z \times \sin \theta_s$
$\cos \theta_s$:	Motor power factor at starting
$\sin \theta_s$:	Motor reactance factor at starting

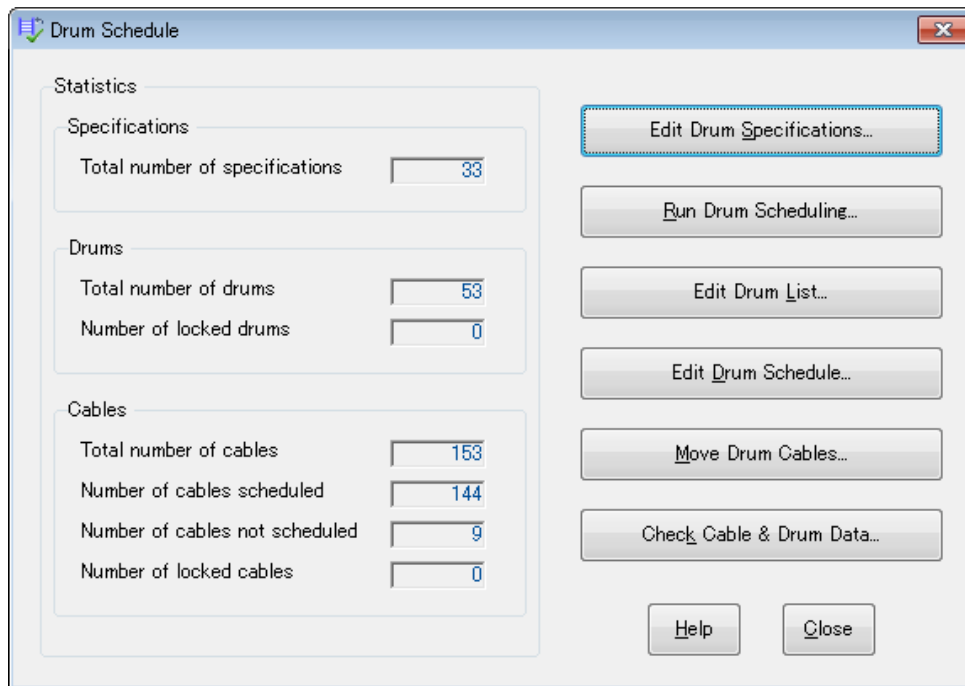
If the calculated $l(m)$ is greater than or equal to the length of load cable, this cable size will be taken as a calculation result.

If not, the next larger size of cable in the cable library will be examined.

13.3 Drum Scheduling

Drum scheduling is a process of collecting identical cables (in terms of specifications and sizes) and allocating them into a spool called Drum. A drum is a roll of cable of certain length.

Procurement of cables is generally transacted in unit of drum. And during the lay out (pulling) of cables at the construction site the cables are drawn out and cut from the drums. For these reasons, a proper management of drum is necessary to facilitate procurement processes and to maximize the usage of the cable in the drums.



The two main purpose of drum scheduling are;

(1) Generate "Drum List"

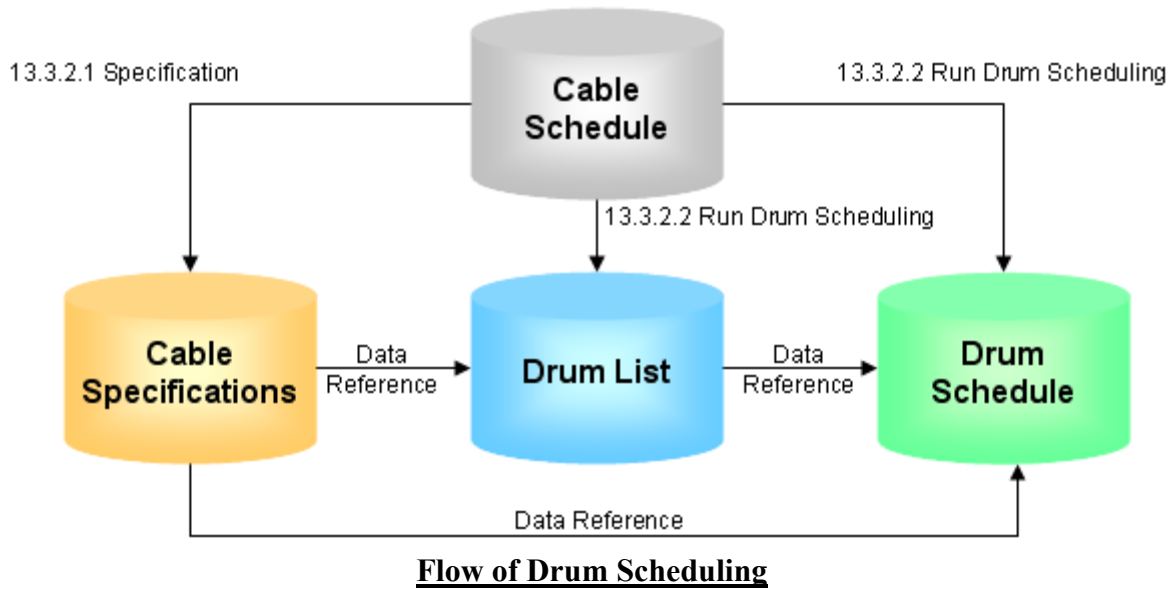
Drum list is a summary of cable drums which enlist pertinent information about the description of the drums. Generally, this list is used for procurement

(2) Generate "Drum Schedule"

Drum schedule is a listing of arrays of cables allocated to a drum. The arrays of cables represent the segments of the cable wound in the drums. In other words, a drum schedule is a table of how the content of a drum will be cut into pieces/sections. Generally, this schedule is used for construction.

Flow of Drum Scheduling

A cable schedule is necessary before drum list and drum schedules can be generated. From the cable schedule, e-DPP collects all distinct cable sizes of distinct specification and summarizes them in table hereto referred as "Drum Specification". A "Drum Specification" table also contains the criteria for the management of the length of cable that will be available in the drums for each distinct cable size of distinct specification.



13.3.1. Statistics

This section conveys the information about the statistics of cables and drums utilized in the project.

Specification

Total number of specifications

This refers to total counts of cables of distinct sizes and distinct specification.

Drums

Total number of drums

This refers to the total counts of registered drums.

Number of locked drums

This refers to the total counts of protected drums (drums immune from changes).

Cables

Total number of cables

This refers to the total counts of cables in the cable schedule.

Number of cables scheduled

This refers to the total counts of cables which were already scheduled to drum.

Number of cables not scheduled

This refers to the total counts of cables which are not yet scheduled to drum.

Number of locked cables

This refers to total counts of protected cables (cables immune from changes).

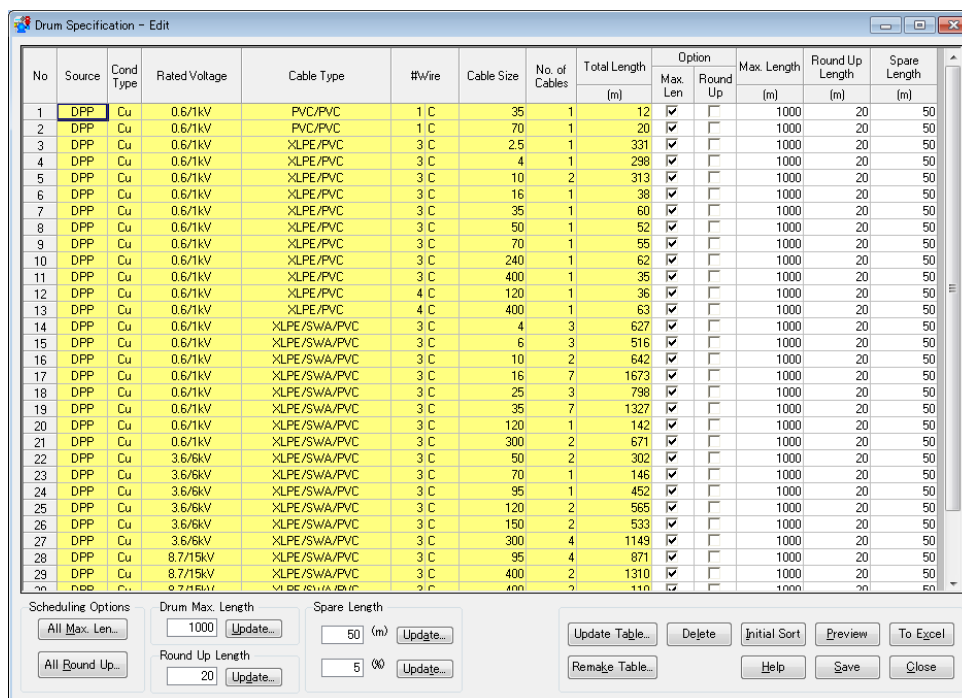
13.3.2. Drum Scheduling Functionalities

The drum scheduling is divided with six functionalities as follows:

- Edit Drum Specifications
- Run Drum Scheduling
- Edit Drum List
- Edit Drum Schedule
- Move Drum Cables
- Check Cable & Drum Data

13.3.2.1 Edit Drum Specification

Clicking "**Edit Drum Specification...**" button brings out the summary of distinct cable sizes of distinct specification and the criteria for the management of the drum length (length of cable in the drum). When this button is clicked, the following dialog appears;



In the above dialog, you can specify the criteria for the management of the length of cable that will be available in the drums for each distinct cable size of distinct specification.

(Note: In this version, the dialog shown above can now be minimized or maximized as desired by the user.)

Table Properties

Option

Select one of the two (2) options "Max. Len" or "Round Up".

Max. Len

If "Max. Len" is selected the maximum length of cable that will be available in a drum will be equal to the value specified in "Max. Length" column. In other words, this option dictates the limitation of the summation of length of the segment of the cables that could be scheduled in a drum according to the fixed value in "Max. Length" column. Also, the actual available spare length of cable in a drum may be equal to or greater than the value specified in "Spare Length" column.

Round Up

If "Round Up" is selected the maximum length of cable that will be available in a drum varies to the rounded-up value of the summation of the length of all segments of cables being scheduled in the drum but not more than the value specified in "Max. Length" column. The rounding number is the value specified in "Round Up Length" column. Also, the actual available spare length of cable in a drum may be equal to or less than the value specified in "Round Up Length" column.

This option may be selected if excessive spare is not required for certain sizes of cables of certain specifications for some reason like for instance the cost per linear length of cable is high and/or the cable manufacturer accepts fractional order.

Notes for both "Max. Len" and "Round Up" option

- a) The cumulative length of segments of cables that could be allocated to the drums is restricted by the "Scheduling Length". "Scheduling Length" is the difference between the values in "Max. Length" and "Spare Length" column ("Max. Length" - "Spare Length").
- b) In case a single (one segment) cable having a length more than the value specified in "Max. Length" column, this single cable will be allocated to a single drum of length equal to "Max. Length". Though consideration can be taken later e.g. increase the drum length later or consider splicing the cable.

Max. Length (m)

This parameter is used to determine the prospective and limitation of length of cable that will be available in a particular drum. By default, this parameter is populated with value from cable library if the corresponding data is available. Otherwise, a default value of 1000(m) is set.

Round-Up Length (m)

This setting is valid only when "Round-Up" option is selected. The default value is 20 (m). Round-Up Length (m) should be less than 50% of Max. Length (m) and equal or less than Spare Length (m).

Spare Length (m)

Specify the prospective length of cable you want to spare in a drum. The default value is 5% of "Max. Length (m)". The actual drum spare length may be at least or at most equal to this value depending on the selected option "Max Len" or "Round Up" as discussed in "1) Option" above.

The Spare Length (m) should be less than 50% of Max. Length (m).

Scheduling Options**All Max. Len...**

Globally set the "Option" to "Max. Len"

All Round Up...

Globally set the "Option" to "Round Up"

Drum Max. Length

Globally assigned value to "Max. Length" according to the data entered in the text box.

Update...

Click "Update..." button to reflect the entered value in the adjacent textbox to the "Max. Length" column of the drum specification table

Round Up Length

Globally assigned value to "Round Up Length" according to the data entered in the text box.

Update...

Click "Update..." button to reflect the entered value in the adjacent textbox to the "Round Up Length" column of the drum specification table

Spare Length

Globally assigned value to "Spare Length"

(m) - Update...

Specify the absolute value of the intended spare length in the text box and click the adjacent button "Update..." to reflect the said value to the "Spare Length" column of the drum specification table.

(%) - Update...

Specify the intended spare length in percent of "Max. Length" in the text box and click the adjacent button "Update..." to reflect the absolute equivalent value of the said percentage value to the "Spare Length" column of the drum specification table.

Command Buttons**Update Table...**

When this button is clicked, the drum specification table will be updated based on the latest cable schedule i.e. new specification will be added if any and/or the counts of cables and their cumulative length (total length) will be updated if any relevant changes were made in the cable schedule. All the user's defined setting and entry (i.e. data in the "Option", "Max Length", "Round Up Length", and "Spare Length" columns) will be unchanged.

Remake Table...

When this button is clicked, the drum specification table will be reset based on the latest cable schedule and the entire user's defined setting and entry will be overwritten with the default setting and data.

Delete

Delete a current row of drum specification which is not necessary anymore. Rows in which "No. of Cables" is more than zero are not allowed to delete.

Initial Sort

Clicking this button returns the sort order to the original state when the dialog opens. This is effective when the original sorting was re-organized by selective sorting. Selective sorting is being done by clicking the header of a particular column on the table. The order of sorting alternatively changes from ascending to descending and vice versa on subsequent click of the mouse at the header.

Preview

Click "Preview" button to view the print layout of the Table in its current state and print as necessary.

Save

Click "Save" button to save the changes made.

To Excel

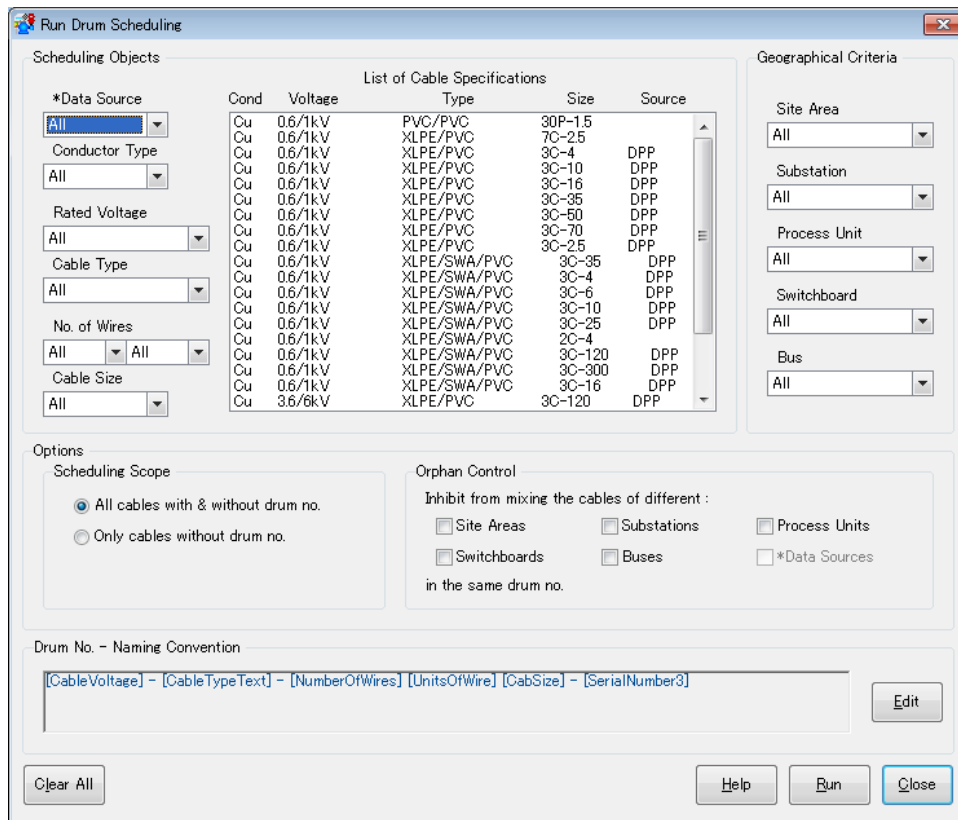
Click "To Excel" button to export the Table in its current state to MS Excel.

Close

Click "Close" button to return to "Drum Schedule" dialog.

13.3.2.2 Run Drum Scheduling

Clicking "Run Drum Scheduling..." button brings out the dialog responsible for creating the "Drum List" and "Drum Schedule". When this button is clicked, the following dialog appears;



Scheduling Objects

Select from the pull down lists which cables of certain size of certain specification are the target of

scheduling. The list of cable specification available for scheduling is shown in the "List of Cable Specification" list box. If the target are all the cables, leave all the pull down list to "All". The pull-down lists behave in hierarchical order i.e. from top to bottom.

Data Source

Select the Data Source of the target cables. Data Source is a name of cable manufacturer (MFRName) in e-DPP cable library and intended to use for discriminating the cable data when different cable manufacturers are selected with identical specification of cables.

When the cable data are not extracted from e-DPP cable library, Data Source list shows a blank. This occurs if the name of manufacturer is not specified when the cable data have been populated by User Data Import or Data Filling action. However, even in such case, the drum scheduling program treats those cables as "Manufacturer name = <blank>" in the same manner as for the other cables.

Conductor Type

Select the conductor type (copper or aluminum) of the target cables.

Rated Voltage

Select the rated voltage of the target cables.

Cable Type

Select the insulation, jacket, mechanical, and/or chemical protection type of the target cables.

No. of Wires

Select the number of conductors and their configuration of the target cables.

Cable Size

Select the size of the target cables.

Geographical Criteria

The Geographical Criteria accounts the relationship of the pulling locations and the equipment to be served. These criteria allow you to optimize your scheduling preparation by automatically putting cables to the right drums. There are two (2) methods to realize an optimal drum scheduling;

- i. Filter the prospect cables for drum scheduling by "Geographical Criteria".
- ii. Use the "Orphan Control"

When "Geographical Criteria" is applied, it is required to manually execute one by one each group of target cables (group of cables of the same location). On the other hand, "Geographical Criteria" has an advantage. For example, in case engineering work in some areas is delayed due to some reasons but in some areas it is already complete and for those completed areas placement of order of the cables is now required, then "Geographical Criteria" may be the best option.

Site Area

Select the site area where the target cables belong.

Substation

Select the substation where the target cables belong.

Process Unit

Select the process unit where the target cables belong.

Switchboard

Select the switchboard where the target cables are served.

Bus

Select the bus where target cables are terminated.

Options**Scheduling Scope**

The following options are effective at the second and subsequent runs. Either the cables that have been already scheduled to drums or the cables that have not been yet can be target of scheduling.

All cables with & without drum no

If this option is selected all cables and drums will be the target of scheduling.

Only cables without drum no

If this option is selected only the cables which have not been scheduled yet to drums will be the target of scheduling.

Include existing drums

This is an additional option to take into account the spare lengths of the existing drums, meaning if a particular cable with certain length can fit in the available spare length of a certain existing drum then this cable will be scheduled to that drum.

Orphan Control

The objective of these Options is to globally optimize scheduling preparation by automatically putting cables to the right drums.

Note: The following options (one or more) are enabled only when their counterpart (pull down list) in the "Geographical Criteria" frame is set to "All" and the subject addressed by the said option is not utilized in the Drum Naming Convention Builder.

Site Areas

Check this checkbox to segregate scheduling of cables by site area.

Substations

Check this checkbox to segregate scheduling of cables by substation.

Process Units

Check this checkbox to segregate scheduling of cables by process unit.

Switchboards

Check this checkbox to segregate scheduling of cables by switchboard.

Buses

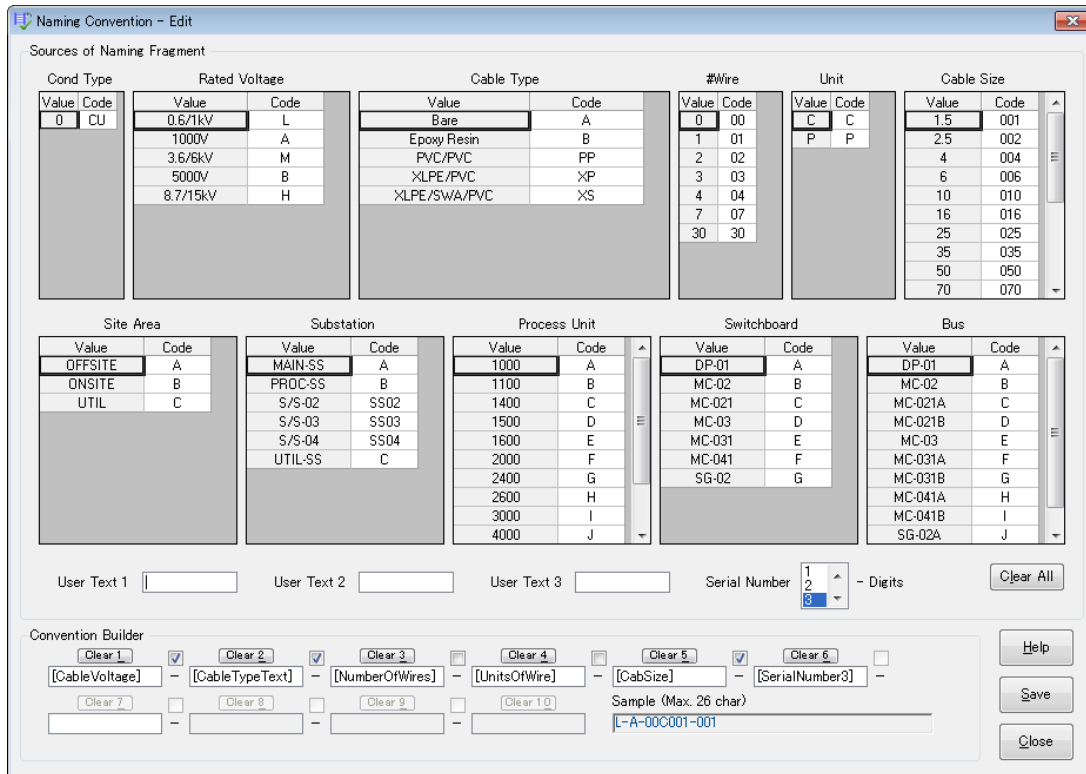
Check this checkbox to segregate scheduling of cables by bus.

Drum No. - Naming Convention

Specified Naming Convention will be displayed on this area.

"Edit" Button

Click "Edit" button to bring out the Drum Naming Convention as shown below.



The drum naming convention is a rule how the drums will be assigned with ID (Drum Number) automatically.

Source of Naming Fragment

The following tables and fields serve the criteria to produce the intended format of the Drum Number.

Tables	
Cond Type	Site Area
Rated Voltage	Substation
Cable Type	Process Unit
#Wire	Switchboard
Unit	Bus
Cable Size	

Fields
User Text 1
User Text 2
User Text 3
Serial Number

The contents (records) of each table are dynamic with the Cable Schedule (meaning their value depends on what is available in the Cable Schedule).

In each table are records of "Value" & "Code". The data in the column "Value" is data extracted from

Cable Schedule and the data in the column "Code" is default or user-defined data that will represent the "Value". Hence, the combination of the "Code" is actually the one that comprises the Drum Number.

e-DPP pre-assigned default abbreviation for the "Code" but the user can later freely assigned any alphanumeric up to 10 characters to yield meaningful message. However, the drum number is limited only up to 26 characters and therefore selection of the Codes and their combination should be exercised thoroughly in order for the resulting drum number not to exceed the said limitation.

Cond Type

This table corresponds to the type of conductor of the cables. The value of "0" and "1" denotes copper and aluminum respectively. The default Code is "CU" for "0" and "AL" for "1".

Rated Voltage

This table corresponds to the rated voltage of the cables. The default Code for each Value is set to alphabet letter.

Cable Type

This table corresponds to the type of insulation, jacket, and other mechanical or environmental protection of the cables. The default Code for each Value is set to alphabet letter.

#Wire

This table corresponds to the number of conductors in the cables. The default Code is set as to the number of conductors in two digits format. For example if the number of conductor is 3, then the corresponding default Code is "03".

Unit

This table corresponds to the configuration of the conductors in the cables, e.g. Core (C) or Pair (P). The default Code is set as same as the Value.

Cable Size

This table corresponds to the size of the cables. The default Code is set as same as the Value with the following exception;

- i) Slash ("/") used in AWG size series like in "4/0" or "2/0" is designated to "S" since this symbol is not allowed by the program to be included in the drum number. For example, the Code for "4/0" is defaulted to "4S0".
- ii) Dot (".") used in metric size series like in "2.5" is designated to "D" due to the same reason as in i). For example, the Code for "2.5" is defaulted to "2D5".

Site Area, Substation, Process Unit, Switchboard, Bus

These tables correspond to the geographical location of the cables where they will be laid out. Their title explains their scope. The default Code for each Value of each table is set to alphabet letter.

User Text 1, User Text 2 & User Text 3

Any static strings (alphanumeric and hyphen) which is required to be part of the drum number may be entered here.

Serial Number

Serial number is a part of drum number that makes a drum number unique in case there is more than one drum of identical specifications (having cable with the same specification). This number corresponds to the count of drums. Therefore, it is a must to have this number. Number of digits from 1 to 5 is available as option for user to choose. The numbers of digits dictate the number of digits of the serial number and it signifies the number of leading zeros less the digits of the count of a particular drum. For example, if you selected number of digits of 4 and the count of a particular drum is 32, then the serial number will be "0032". In case user has chosen number of digits less than the number of digits of the count of a particular drum, the exact number of the count will be utilized. But the presentation of those counts which exceed and those which are within the chosen number of digits will be different. For example, if the chosen Number of Digits is 3, all counts less than 1000 will be presented in 3 digits (001 to 999) and those 1000 and above will be presented in more than 3 digits (1001 to ?).

"Clear All" Button

Clicking on this button resets all the settings to default pre-assigned setting. "Convention Builder" is reset as well and only "Serial Number - 3 Digits" remains.

Convention Builder

There are Ten (10) sections in the "Convention Builder" frame and combination of these sections will comprise the Drum Numbers. Each section needs to be filled-in from any of the 15 items in the "Source of Naming Fragment" frame by drag and drop operation.

Notes:

- i. Each item in the "Source of Naming Fragment" can only be used once in the "Convention Builder".
- ii. At least one section in the "Convention Builder" is should be filled-in by "Serial Number" from the "Source of Naming Fragment".

"Clear 1" to "Clear 10" Button

Clicking this button clears the section (textbox) underneath. Empty sections are eliminated after execution of "Save" button and reopening of the dialog.

"-" (Hyphen)

Check the checkbox above the hyphen label to inserts a hyphen between the adjacent sections.

Sample (Max. 26 char)

A sample of the drum number is reflected here for reference. It shows dynamically the format of the drum number related to the product of the convention builder.

As the maximum length of drum number is limited to 26 characters, this textbox will help you distinguish if you exceed such limitation.

"Save" Button

Click "Save" button to save the changes made.

"Close" Button

Click "Close" button to return to "Run Drum Scheduling" dialog.

Command Buttons

Clear All

Click "Clear All" button to delete the drum list and all drum schedules.

Run

Click "Run" button to execute drum scheduling. (Confirmed if desired to open drum list editor)

Close

Click "Close" button to return to main dialog.

13.3.2.3 Edit Drum List

Clicking "Edit Drum List..." button brings out the Drum List Editor dialog as shown below. Alternatively, this dialog can be opened immediately after the execution of Drum Scheduling.

No	Lock	Drum No.	Source	Cond Type	Rated Voltage	Cable Type	#Wire	Cable Size	No of Cables	Total Length (m)	Spare Length (m)	Drum Length (m)	PO No.
1	<input type="checkbox"/>	HXS-03C095-001	DPP	Cu	8.7/15kV	XLPE/SWA/PVC	3 C	95	4	871	129	1000	
2	<input type="checkbox"/>	HXS-03C400-001	DPP	Cu	8.7/15kV	XLPE/SWA/PVC	3 C	400	2	110	890	1000	
3	<input type="checkbox"/>	HXS-03C400-002	DPP	Cu	8.7/15kV	XLPE/SWA/PVC	3 C	400	1	1250	-250	1000	
4	<input type="checkbox"/>	HXS-03C400-003	DPP	Cu	8.7/15kV	XLPE/SWA/PVC	3 C	400	1	60	940	1000	
5	<input type="checkbox"/>	LPP-01C035-001	DPP	Cu	0.6/1kV	PVC/PVC	1 C	35	1	12	988	1000	
6	<input type="checkbox"/>	LPP-01C070-001	DPP	Cu	0.6/1kV	PVC/PVC	1 C	70	1	20	980	1000	
7	<input type="checkbox"/>	LPP-30P001-001		Cu	0.6/1kV	PVC/PVC	30 P	1.5	15	900	100	1000	
8	<input type="checkbox"/>	LPP-30P001-002		Cu	0.6/1kV	PVC/PVC	30 P	1.5	15	900	100	1000	
9	<input type="checkbox"/>	LPP-30P001-003		Cu	0.6/1kV	PVC/PVC	30 P	1.5	7	420	580	1000	
10	<input type="checkbox"/>	LXP-03C002-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	2.5	1	331	669	1000	
11	<input type="checkbox"/>	LXP-03C004-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	4	1	298	702	1000	
12	<input type="checkbox"/>	LXP-03C010-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	10	2	560	440	1000	
13	<input type="checkbox"/>	LXP-03C016-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	16	1	280	720	1000	
14	<input type="checkbox"/>	LXP-03C035-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	35	1	280	720	1000	
15	<input type="checkbox"/>	LXP-03C050-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	50	1	280	720	1000	
16	<input type="checkbox"/>	LXP-03C070-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	70	1	280	720	1000	
17	<input type="checkbox"/>	LXP-03C240-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	240	1	62	938	1000	
18	<input type="checkbox"/>	LXP-03C400-001	DPP	Cu	0.6/1kV	XLPE/PVC	3 C	400	1	35	965	1000	
19	<input type="checkbox"/>	LXP-04C120-001	DPP	Cu	0.6/1kV	XLPE/PVC	4 C	120	1	36	964	1000	
20	<input type="checkbox"/>	LXP-04C400-001	DPP	Cu	0.6/1kV	XLPE/PVC	4 C	400	1	63	937	1000	
21	<input type="checkbox"/>	LXP-07C002-001		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	
22	<input type="checkbox"/>	LXP-07C002-002		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	
23	<input type="checkbox"/>	LXP-07C002-003		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	
24	<input type="checkbox"/>	LXP-07C002-004		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	
25	<input type="checkbox"/>	LXP-07C002-005		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	
26	<input type="checkbox"/>	LXP-07C002-006		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	
27	<input type="checkbox"/>	LXP-07C002-007		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	
28	<input type="checkbox"/>	LXP-07C002-008		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	
29	<input type="checkbox"/>	LXP-07C002-009		Cu	0.6/1kV	XLPE/PVC	7 C	2.5	3	900	100	1000	

In the above dialog, "Lock", "Drum Length (m)", "PO No." and "Maker" columns may be edited.

(Note: In this version, the dialog shown above can now be minimized or maximized as desired by the user.)

Table Properties

Lock

Checking "Lock" cell protects the drum and its contents (cables) against changes when the drum scheduling is re-executed. This function is useful to mark the drums that have been already ordered to

manufacturer.

Drum Length (m)

Alter the drum length as necessary.

PO No. & Maker

You may enter any data in "PO No." and "Maker" columns for additional information.

Command Buttons

Lock All & Unlock All

Check or uncheck all the cells in the "Lock" column in one step.

Show New Drum No. & Hide New Drum No.

Clicking "**Show New Drum No.**" button shows "New Drum No." column in the table where you can enter a new drum number. Note that the new drum number should be unique and up to 26 character long only.

Create New Drum

Click "Create New Drum" button to create a new drum to which unscheduled cables may be scheduled manually.

Drum Specifications

New Drum No.

Data Source

Conductor Type Copper

Rated Voltage 0.6/1kV

Cable Type PVC/PVC

No. of Wires 30 P

Cable Size 1.5

Drum Length (m) 1000

Help OK Cancel

New Drum No.

Enter a new unique drum number up to 26 characters

Data Source

Select the Data Source that the drum will cater.

Conductor Type, Rated Voltage, Cable Type, No. of Wires, Cable Size, & Drum Length (m)

These parameters describe the specification of the new drum. Select the appropriate parameters.

Delete Drum

Click "Delete Drum" button to delete the currently selected drum. Note that only empty drums (no scheduled cables) can be deleted.

Filter / Unfilter

Click "Filter" button to perform filter by selection. The currently selected cell serves as the filtering criteria. Click "Unfilter" button to restore the table.

To Excel

Click "To Excel" button to export the Table in its current state to MS Excel.

Preview

Click "Preview" button to view the print layout of the Table in its current state and print as necessary.

Save

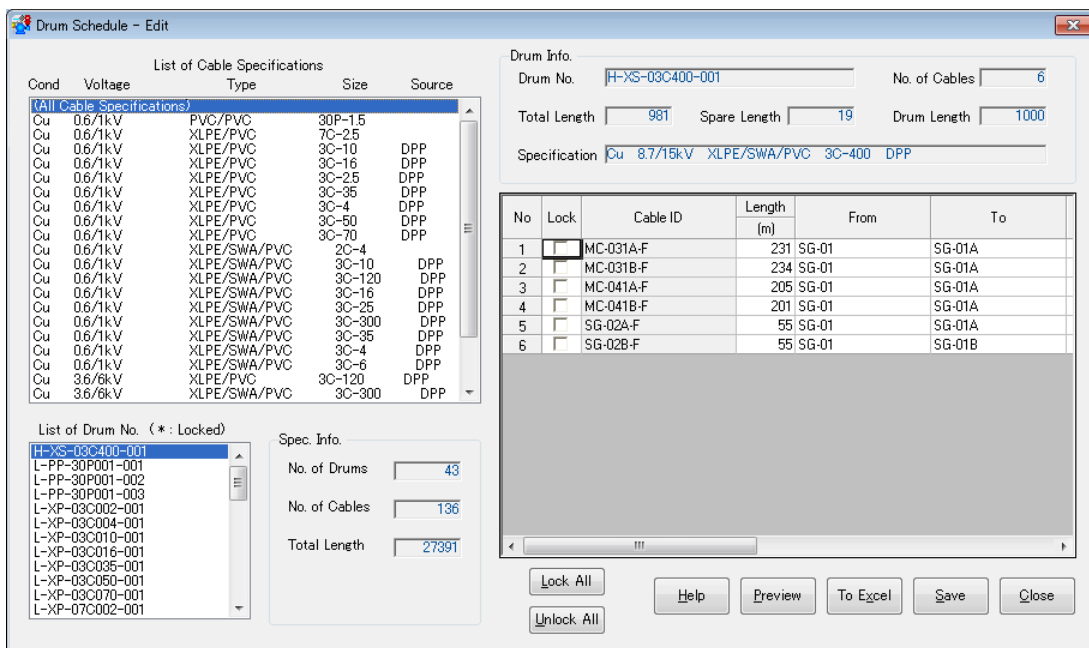
Click "Save" button to save the changes made.

Close

Click "Close" button to return to "Run Drum Scheduling" dialog.

13.3.2.4 Edit Drum Schedule

Click the "Edit Drum Schedule..." button if you want to edit some data in some cables (data which has relevance to geographical information only). This action will open the following dialog;



List of Cable Specifications

Select from the list of the cable specification you wish to modify.

List of Drum No. (* :Locked)

The drums bearing the specification selected in the "List of Cable Specification" are shown here. In this list, select the drum number where the cable you wish to modify belongs.

Spec. Info.

The "No. of Drums", "No. of Cables", and "Total length" involved in the selected specification on "List of Cable Specifications" are shown in this frame for information.

Drum Info.

Relevant information of the Drum selected in the "List of Drum No." is shown in this frame.

Spread Table

The scheduled cables in a particular drum selected in "List of Drum No." are shown here. Here you can edit the cable literature like, "Lock", "Length (m)", "From", "To", "Site Area", "Substation", "Process Unit", "Switchboard", and "Bus".

If the length of some cables is increased and in total exceeds the drum length, an alert message will warn you. You can either shorten the length of some cables to meet the drum length (but seems not appropriate) or just note the message and save the changes and later move some cables to other drums.

Command Buttons**Lock All & Unlock All**

Check or uncheck all the cells in the "Lock" column in one step.

Preview

Click "Preview" button to view the print layout of the Table in its current state and print as necessary.

Save

Click "Save" button to save the changes made.

Close

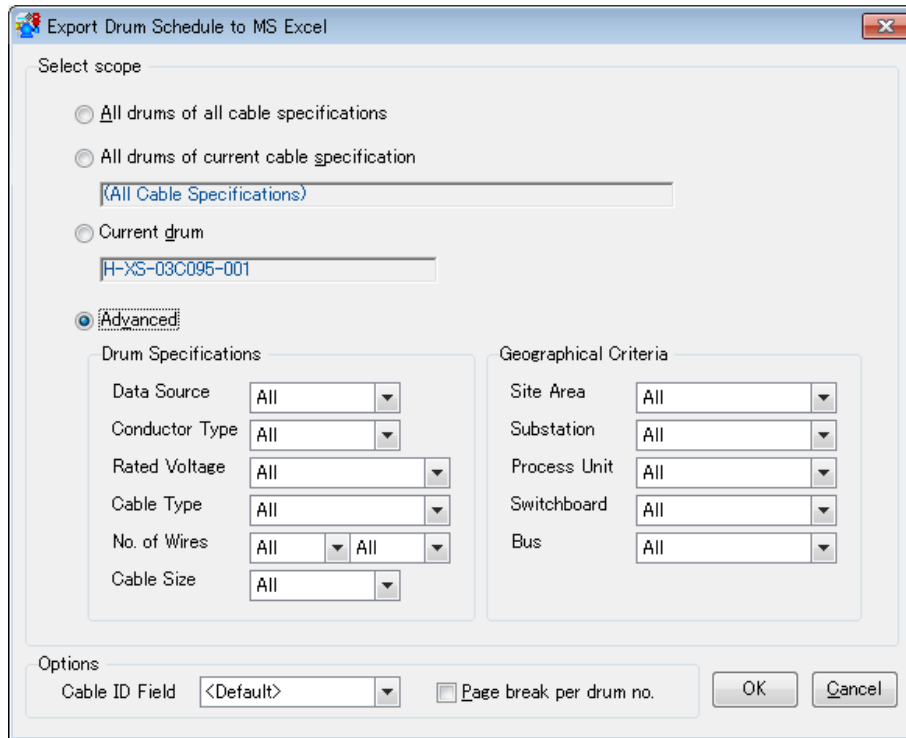
Click "Close" button to return to main dialog.

To Excel

Click "To Excel" button to bring out the option dialog as shown below and eventually export drum schedule(s) to MS Excel.

Note:

"Site Area", "Substation", "Process Unit", "Switchboard", and "Bus" columns are now available when exporting Cable Drum Schedule on MS Excel by "To Excel" button. Such columns were initially hidden upon exporting. When the user would like to include those columns, "Unhide" MS Excel function must be used. (Select both the boundary columns, right-click and select "Unhide".)



Select scope

All drums of all cable specifications

All the drums existing in the current drum schedule will be exported to MS Excel.

All drums of current cable specification

All the drums of the currently selected cable specification in "**Drum Schedule - Edit**" dialog will be exported to MS Excel.

Current drum

Only the drum currently selected in "**Drum Schedule - Edit**" dialog will be exported to MS Excel.

Advanced

Select this option then select from the pull down list the conditions on what to export to MS Excel. Each item is combined with AND operator.

Options

Cable ID Field

Select a desired field from the drop down list to be shown in the MS Excel sheets on "Cable No." column.

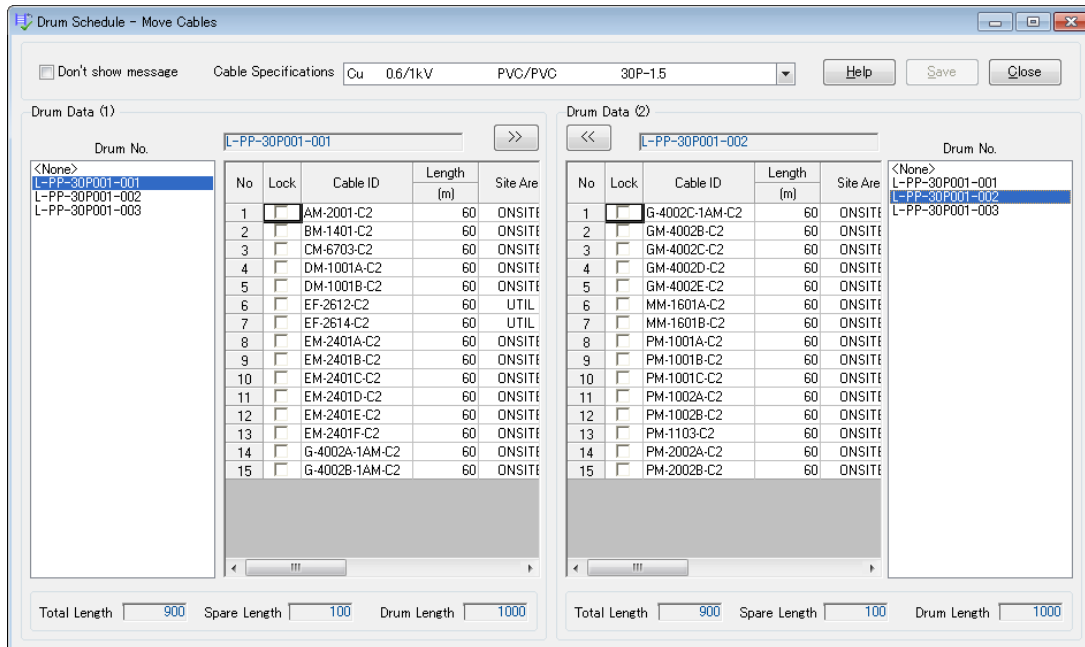
(Note: Options are the naming conventions created by the user on user defined fields to cover all possible project requirements.)

Page break per drum no.

Check this checkbox to inserts a page break per drum number in MS Excel sheets.

13.3.2.5 Move Drum Cables

Click "Move Drum Cables..." button if you want to manually move some cables from one drum to another due to some reasons. This action will open the following dialog;



As mentioned above, in this dialog, cables can be moved from one drum to another drum of same specification (same cable specification). Movement is done by drag & drop or arrow button operation. Neither "Lock", "Cable ID", "Length (m)", "Site Area", "Substation", "Process Unit ID", "Switchboard" nor "Bus" parameters can be edited in this dialog.

Cable Specifications

Select a cable specification from this pull down list. Think of this "Select Cable Specification" pull down list as a filter criterion for the Drums. Meaning the drums that will be shown in the "Drum Data (1)" and "Drum Data (2)" panes have a cable specification as the selected one in the "Select Cable Specification" pull down list.

Drum Data (1) & Drum Data (2)

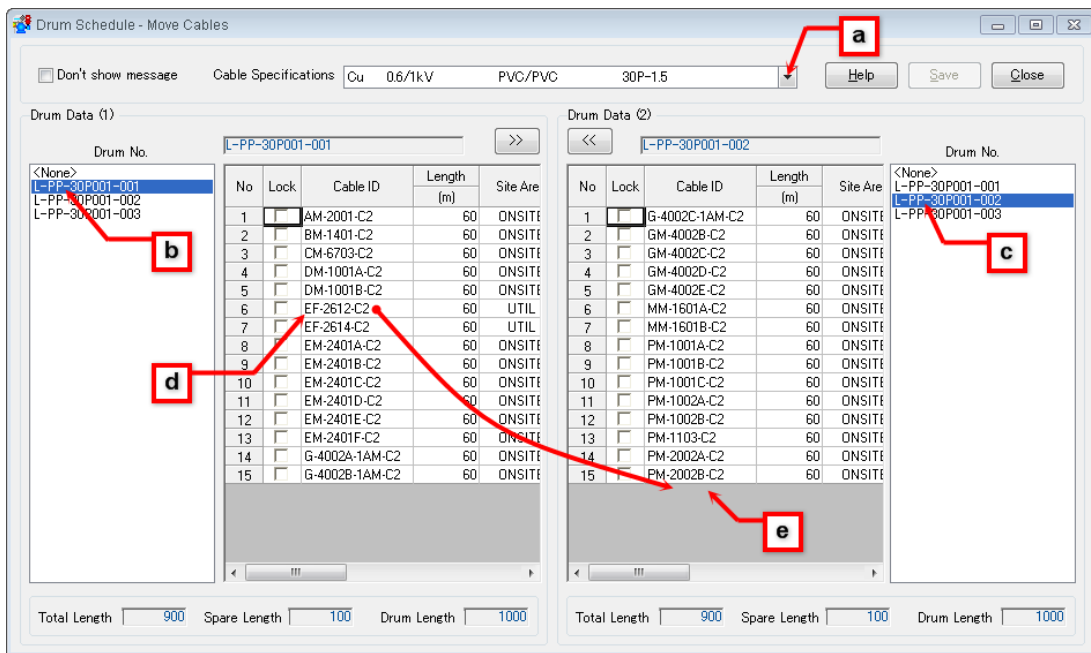
The dialog is generally divided into two (2) panes, the "Drum Data (1)" pane and the "Drum Data (2)" pane. Both panes contain the same drums (drum no.) and a virtual drum named "<None>". This "<None>" drum en-houses all unscheduled cables. By manipulation of drum selections in the "Drum Data (1)" pane and in the "Drum Data (2)" pane, you will be able to move cables from one drum to another in both directions.

Movement by Drag & Drop Mouse Operations

I. To move cables by Drag & Drop operations from one to another drum:

- a) Select the specification of cable you wish to move in the "Select Cable Specification" pull down list. The drums having that specification will be listed in the Drum Data (1) & (2).

- b) On Drum Data (1), select the drum number having the cable(s) you wish to move.
- c) On Drum Data (2), select the drum number where you wish to move the cable.
- d) On the Drum Data (1) point to the Cable ID and drag & drop to the cable list section of the Drum Data(2).
- e) Moved Cable ID from Drum Data (1) will be displayed on this area.

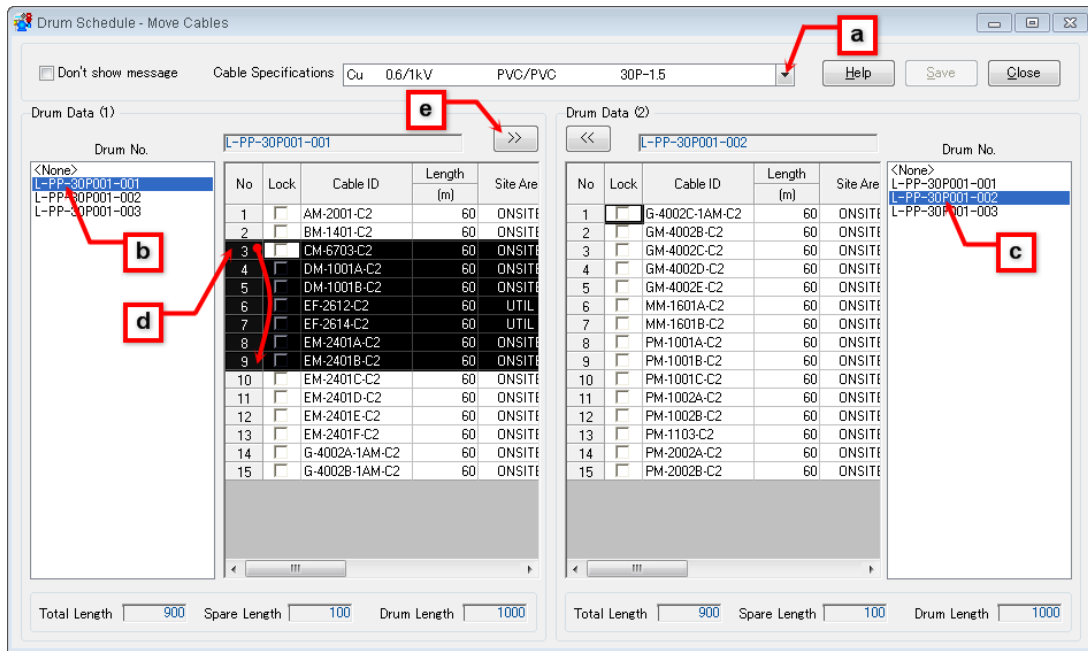


Note:

- i) Process of moving of Cable ID stated above can be done also from Drum Data (2) to Drum Data (1).

II. To move more than one cable at once:

- a) Select the specification of cable you wish to move in the "Select Cable Specification" pull down list. The drums having that specification will be listed in the Drum Data (1) & (2).
- b) On Drum Data (1), select the drum number having the cable(s) you wish to move.
- c) On Drum Data (2), select the drum number where you wish to move the cable(s).
- d) On Drum Data (1), point to the row headers (the cells under "No" column) of the starting cable and drag to ending cable you wish to move. The highlighted cables are subject to move.
- e) Click ">>>" button.



Note:

- i) Only adjacent cables can be selected.
- ii) If you want to select all cables, click the "No" cell (upper-left most corner cell)
- iii) Process of moving of Cable ID(s) stated above can be done also from Drum Data (2) to Drum Data (1).

Don't show message

Check "Don't show message" checkbox to disable the warning message box which keeps on warning you whenever the total length of cable scheduled in a certain drum exceed the drum length as result of the moving cable to other drums.

Save

Click "Save" button to save the changes made.

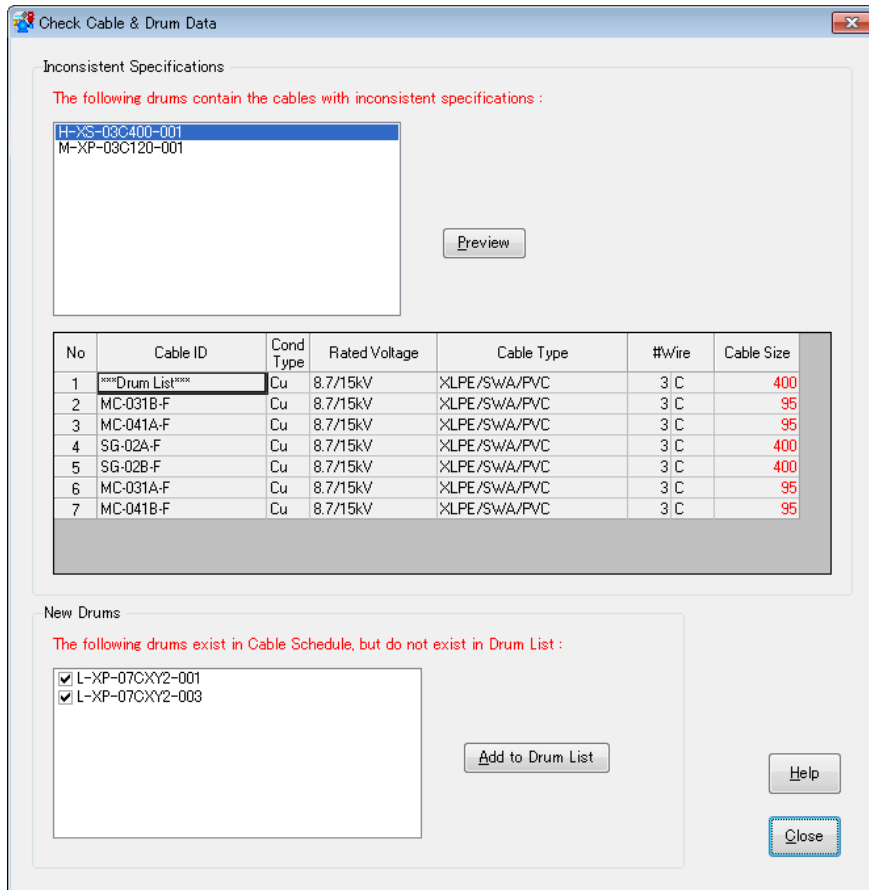
Close

Click "Close" button to return to main dialog.

13.3.2.6 Check Cable & Drum Data

By virtue of editing cables outside of Drum Scheduling program (e.g. in Cable schedule), inconsistency in the structure of the drum schedules and drum list may occur. For example: 1) Cables of certain specification might be assigned to drums of different specification, 2) New drums might be specified in cable schedule though do not exist in the drum list. e-DPP can detects these two (2) cases of inconsistency.

Click "Check Cable & Drum Data..." button to check the said inconsistency. This action will open the following dialog;



Inconsistent Specifications

This area enlists the drums and their contents having disagreement between the specification of the drums themselves and the specification of one or more cables assigned to them. The inconsistent parameters are highlighted in red color.

It is a must to resolve the inconsistency by correcting the relevant items in the cable schedule or re-execute drum scheduling (either manually un-schedule from the drum the inflicted cables or re-run drum scheduling).

Preview

Click "Preview" button to view the print layout of the complete list of cables (where the specification of one or more cables are inconsistent against the drum specification) belonging to the currently selected drum and print as necessary.

New Drums

This area enlists the drums that exist in the cable schedule but do not exist in the drum list. This situation happens when user entered certain drum numbers not registered in the drum list in the cable schedule.

Check the checkbox adjacent to the drum number to qualify them for addition to the drum list

"Add to Drum List" Button

Click "Add to Drum List" button to add the checked new drums to the drum list.

13.4 Conduit and Gland Sizing

The conduit and cable gland sizing can be performed for all or part of cables (power, control, etc.) stored in the cable schedule provided these cables have a counterpart in one of the Cable Libraries.

In order to perform the sizing, "Conduit and Cable Gland Selection Table" needs to be created beforehand in the menu "Defaults - Conduit and Gland Size". Also, under the "Conduit and Cable Gland Selection Table" window environment it is important for each newly selected cable library (or already selected but no prior commencement of clicking the "Edit" button yet) the "Edit" button is clicked in order e-DPP program could generate the corresponding conduit and gland selection table which will be referred by the Conduit and Gland sizing. Otherwise, the Conduit and Gland Sizing program will not yield the expected results. Refer to Chapter 13, clause 13.8.2 (Command Buttons) for more information.

The data that are actually filled out by this program are;

- Conduit Type
- Conduit Size
- Cable Gland Type
- Cable Gland Size
- Cable Entry (Thread) Type
- Cable Entry (Thread) Size

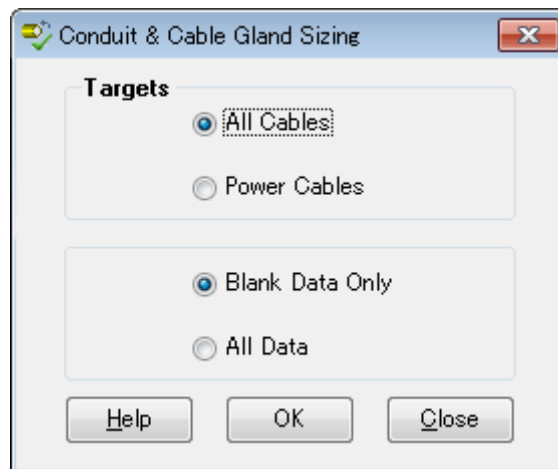
When the following key parameters match "Conduit and Gland Selection" table and the cable schedule, the above listed 6 parameters are transferred from the former to the latter.

- Cable Manufacturer Name
- Cable Voltage
- Cable Type
- No. of Cores

<Note>

The conduit sizing can be performed for single cable only that is installed in a conduit. Multiple cables installed in a conduit cannot be treated. Therefore, "Percentage of Cross-Section" for single conductor only in "Conduit and Gland Selection" table dialog is valid for the conduit sizing.

13.4.1 Entrance Menu



Targets

All Cables

All cables (Power, Control, Communication, etc.) stored in the cables schedule become targets of the sizing.

Power Cables

Only power cables stored in the cables schedule become targets of the sizing.

Blank Data Only

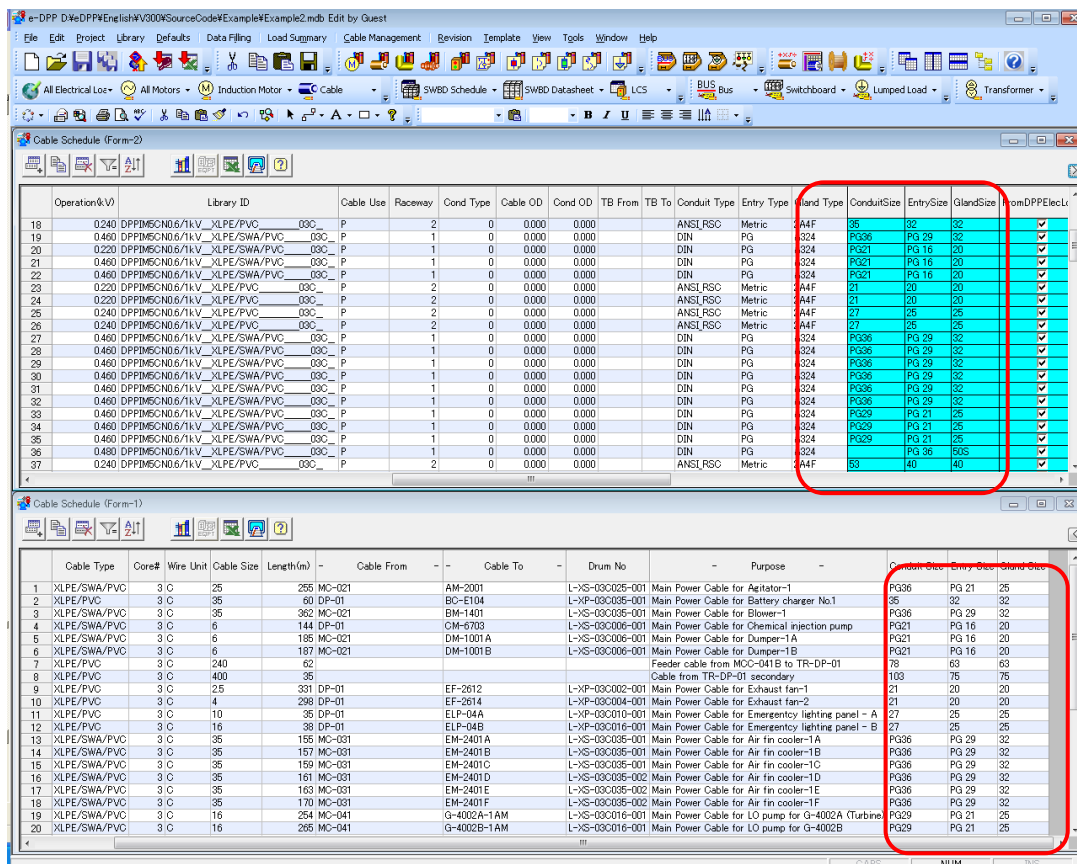
Cable data where their conduit and cable gland type/size are not yet filled become targets of the sizing. The existing non-blank data are bypassed.

All Data

Both blank and non-blank data become targets of the sizing.

13.4.2 Results

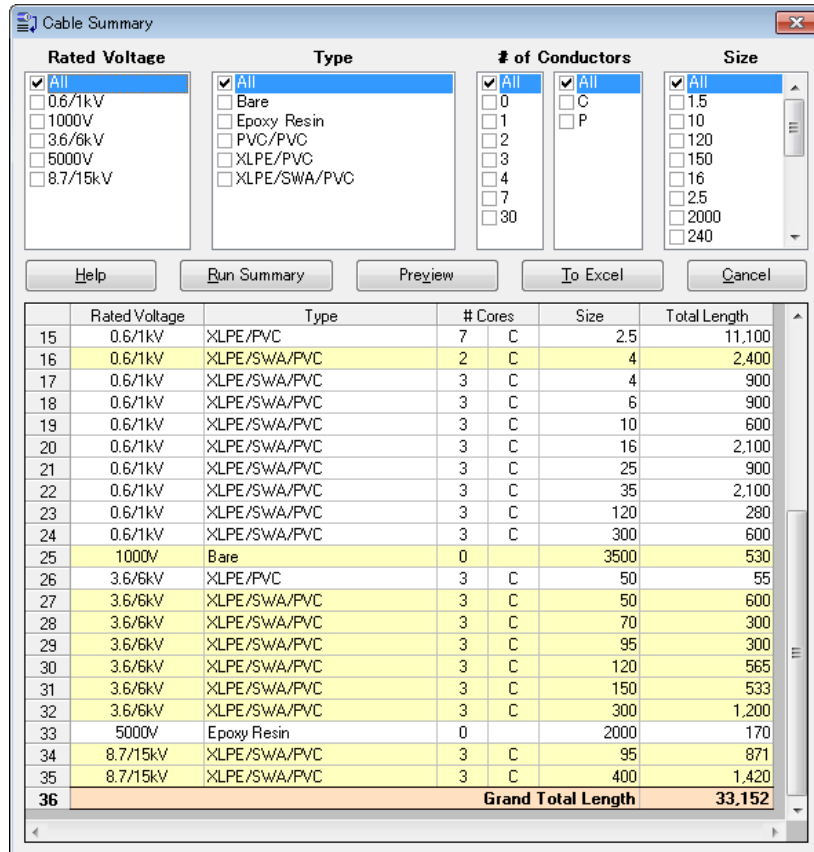
You can confirm the results of conduit and cable gland sizing on the edit windows of cable schedule (DPPCable1 and DPPCable2).



The entry thread types which have been filled from Project Default Data - Cable Entry will be overwritten by the results of conduit and gland sizing program.

13.5 Cable Summary

The Cable Summary tool allows you to generate report of all the cables utilized in your project. The summary is in terms of the quantities of the cables.



13.5.1 Cable Summary Criteria

Rated Voltage

Select the rated voltage of the cables of interest as one of the criteria of the summary.

Type

Select the type of insulation/jacket of the cables of interest as another criterion of the summary.

of Conductors

Select the number and unit of construction of the conductors of the cables of interest as another criterion of the summary.

Size

Select the size of the cables of interest as another criterion of the summary.

Note: The items appearing on the list box of Rated Voltage, Type, # of Conductors, and Size are limited by data available in the cable schedule.

Setup

Click on "Setup" button to display the Setup dialog box which contains options that allow you to setup the printing preferences.

Close

Click on "Close" button to close and return to Cable Summary Dialog.

To Excel

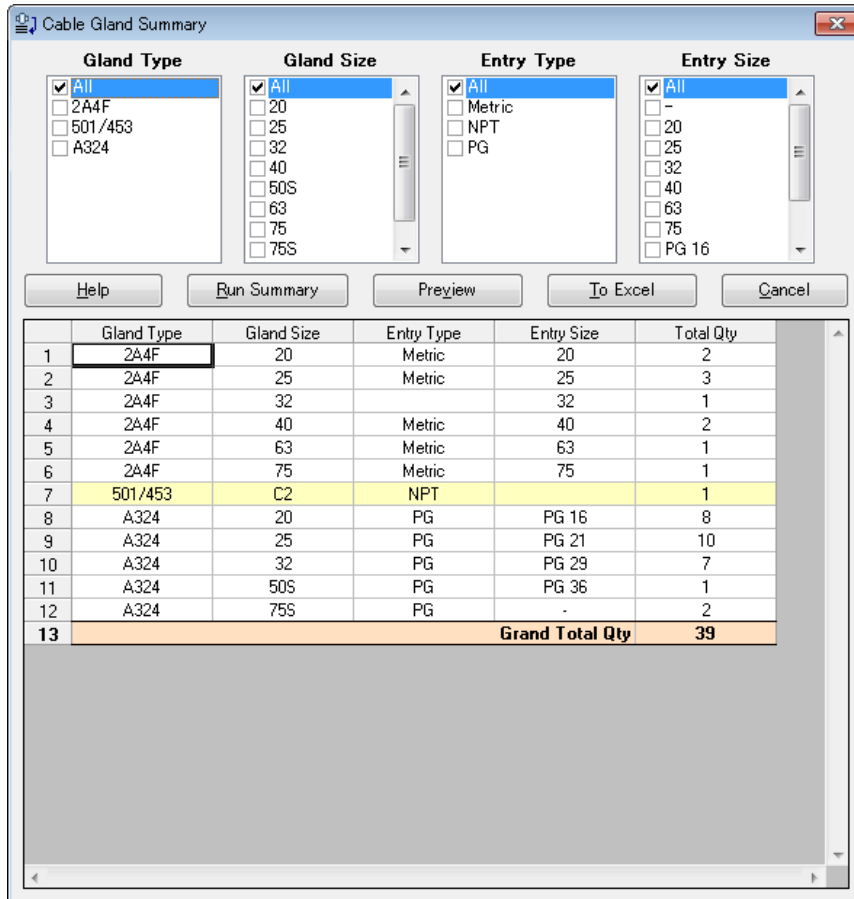
Click on "To Excel" button to output directly the cable summary in an external MS-Excel file. To save a copy, select File→Save-as in the MS-Excel environment and assign a new file name.

Cancel

Click on "Cancel" button to close the Cable Summary Dialog window.

13.6 Gland Summary

The Gland Summary tool allows you to generate report of the entire gland utilized in your project. The summary is in terms of the quantities of the glands.



13.6.1 Gland Summary Criteria

Gland Type

Select the type of the glands of interest as one of the criteria of the summary.

Gland Size

Select the size of the glands of interest as another criterion of the summary.

Entry Type

Select the entry type of the glands of interest as another criterion of the summary.

Entry Size

Select the entry size of the glands of interest as another criterion of the summary.

Note: The items appearing on the list box of Gland Type, Gland Size, Entry Type, and Entry Size are limited by data available in the cable schedule.

Setup

Click on "Setup" button to display the Setup dialog box, which contains options that allow you to setup the printing preferences.

Close

Click on "Close" button to close and return to Cable Summary Dialog.

To Excel

Click on "To Excel" button to output directly the cable summary in an external MS-Excel file. To save a copy, select File→Save as in the MS Excel environment and assign a new file name.

Cancel

Click on "Cancel" button to close the Cable Summary Dialog window.

13.7 Minimum Cable Size

The Minimum Cable Size Table (**DPPMinCabSize**) defines the minimum cable size for each output (kW or HP) of LV, MV and HV motor. If the results of cable sizing routine (refer to **Chapter 13.1, Power Cable Sizing**.) show smaller cable sizes than those defined in **DPPMinCabSize**, the calculated cable sizes are replaced with the minimum cable sizes defined in **DPPMinCabSize**. (There is an option switch to do so or not.)

Only one **DPPMinCabSize** is created for all applicable motor voltage classes (LV-1 (3Ph), LV-2 (3Ph), LV (1Ph), MV1, MV2, HV1 and HV2) together. However, only the voltage classes that have been set to non-zero values in "Project Information" (see **Chapter 8, Project Menu**) are effective for creating **DPPMinCabSize**. The other ineffective voltage classes will be disabled to select by a user.

13.7.1 Entrance Menu

Motor Voltage Class	Rated Voltage (kV)	Min Cable Size Table Exists
<input checked="" type="radio"/> LV-1 (3ph)	0.46	<input checked="" type="checkbox"/>
<input type="radio"/> MV-1	4	<input checked="" type="checkbox"/>
<input type="radio"/> MV-2	-	<input type="checkbox"/>
<input type="radio"/> HV-1	-	<input type="checkbox"/>
<input type="radio"/> HV-2	13.2	<input type="checkbox"/>
<input type="radio"/> LV-2 (3ph)	0.22	<input checked="" type="checkbox"/>
<input type="radio"/> LV (1ph)	0.1	<input type="checkbox"/>

Motor Output Unit

Select Motor Output Unit either "HP" or "KW".

Cable Size Unit

Select Cable Size Unit either "Metric" or "English".

Conduit Size Unit

Select the Conduit Size Unit, "Metric" or "English".

Cable Data

Applicable Standard

The standard applicable to cables selected in "Project → Standard" menu is shown in this cell.

Rated Voltage

Cable rated voltage corresponding to the active "Motor Voltage Class" selected in "Project → Electrical" menu is shown in this cell.

Motor Voltage Class

Selects one of the motor voltage classes that have been defined in "Project Information" for which a part of **DPPMinCabSize** is being edited. Only one class can be selected at a time.

When the corresponding records already exist, e-DPP immediately enters an edit mode. The check boxes indicating existence of data are shown in the right area of each motor voltage class.

Material Types**Cable Manufacturer**

The uniquely filtered values of the cable manufacturer field in the cable library appear on the selection box. The default value initially shown is "DPP".

Cable Type

The values of cable type field in the cable library are shown on the selection box.

Conduit Type

All the values of the conduit type field in the conduit library appear on the selection box.

Gland Type

All the values of the cable gland type field in the cable gland library appear on the selection box.

Cable Entry Type

The value list for the cable entry type field in the cable gland library is used for selection of this item. ("M", "NPT", "PG", "PF" and "ET")

A default value shown on the box is the previously selected one in "Project Information".

Minimum Size Calculation By Fault Current**Cable Conductor Type**

Select the type of cable conductor either "Copper" or "Aluminum" which is used to calculate the minimum cable size to withstand a fault current input below.

When "Motor Voltage Class" is LV-1 (3Ph), LV-2 (3Ph) or LV (1Ph), this item is disabled to select.

Standard

Select Cable Standard either "IEC" or "JIS" which is used to calculate the minimum cable size as well.

When "Motor Voltage Class" is LV-1 (3Ph), LV-2 (3Ph) or LV (1Ph), this item is disabled to select.

Insulation Material

All the values of cable insulation materials filtered with "Conductor Type" and "Standard" specified above are indicated in the selection box. Select one of them, which is used to calculate the minimum

cable size as well.

When "Motor Voltage Class" is LV-1 (3Ph), LV-2 (3Ph) or LV (1Ph), this item is disabled to select.

Fault Clearing Time (sec)

Enter a numeric value in the range of 0 - 1.0 (sec) which is used to calculate the minimum cable size as well.

When "Motor Voltage Class" is LV-1 (3Ph), LV-2 (3Ph) or LV (1Ph), this item is disabled to enter.

Fault Current (kA)

Enter a numeric value in the range of 0 – 100 (kA) which is used to calculate the minimum cable size as well.

When "Motor Voltage Class" is LV-1 (3Ph), LV-2 (3Ph) or LV (1Ph), this item is disabled to enter.

"Calc" Button

When this button is clicked, "Calculated Min. Size (mm2)" is calculated and its result is shown.

"Clear" Button

When this button is clicked, the input fields "Fault Clearing Time (sec)", "Fault Current (kA)" and "Calculated Min. Size (mm2)" are cleared.

Calculated Min. Size (mm2)

The program calculates this value with the following formulas and shows its result on the text box, which is disabled to edit;

"Calculated Min. Size (mm2)"

$$= 1000 * \text{"Fault Current (kA)"} * \text{sqrt ("Fault Clearing Time (sec)")} / [\text{Coefficient}]$$

Coefficient is stored in the e-DPP system database.

"Edit" Button

When "Edit" button is clicked, another window as shown in **Section 13.7.2** appears for editing switch devices, the minimum cable sizes, conduit sizes and gland sizes of the selected motor voltage class.

"Delete" Button

When "Delete" button is clicked, all the records of the minimum cable sizes belonging to the selected motor voltage class are deleted from **DPPMinCabSize**. A warning message appears for your confirmation before deletion is taken place.

13.7.2 Editor

	KW	Switch Device	Cable Size	Conduit Size	Entry Size	Gland Size	Remarks
1	0.4		4	25		O	
2	0.75		4	25		O	
3	1.5		4	25		O	
4	2.2		4	25		O	
5	3		4	25		O	
6	3.7		4	25		O	
7	5.5		6	25		O	
8	7.5		6	25		O	
9	11		10	32		A	
10	15		10	32		A	
11	18.5		16	32		A	
12	22		16	32		A	
13	30		25			B	
14	37		35			B	
15	45		50			B	
16	55		70			Cs	
17	60		70			Cs	
18	75		95			C2s	
19	90		120			C2s	
20	110		185			Ds	
21	132		240			Es	

Editing the minimum cable sizes is performed on the above form. The upper area of the form indicates the field contents input in the entrance menu. The lower area indicates the field contents of table **DPPMinCabSize**.

Switch Device

Select from Fuse, CB or MCCB (for future).

Cable Size

If you like to change the minimum cable size, select the other size from the list box.

If the calculated minimum cable size is effective (MV-1, MV-2, HV-1 & HV-2) and an newly selected size is less than that, a warning message is shown.

Conduit Size

When new records are created in **DPPMinCabSize** or "Conduit Type" changes from the previous one, the conduit size (record) corresponding to the minimum cable size is retrieved as an initial value from the conduit library with the following criteria;

Minimum conduit size (minimum **Inner Diameter**) that satisfies;

$$[\text{Inner Diameter}] **2 \geq [\text{Cable O.D.}] **2 / [\text{Ratio of Cross Section for One Conductor}]$$

"Ratio of Cross Section" can be referred or changed in the entrance menu of the Conduit & Cable

Gland Selection Table. (See **Section 10.4.1, Entrance Menu.**)

When the corresponding record is not found in the cable or conduit library, the conduit size will be left blank.

If you like to change the calculated conduit sizes, select the other size from the list box.

Gland Size

When new records are created in **DPPMinCabSize** or "Gland Type" changes from the previous one, the gland size (record) corresponding to the minimum cable size is retrieved as an initial value from the cable gland library with the following criteria;

Minimum gland size (minimum **Cable O.D. Max for Gland**) that satisfies;

$$[\text{Cable O.D. Max for Gland}] \geq [\text{Cable O.D.}]$$

When the corresponding record is not found in the cable or gland library, the gland size will be left blank.

If you like to change the calculated gland sizes, select the other size from the list box.

Entry Size

When new records are created in **DPPMinCabSize** or "Entry Type" changes from the previous one, the entry size of gland (record) corresponding to the selected gland type/size and entry type is retrieved as an initial value from the cable gland library.

"Entry Size" is indication only and not editable. Values of "Entry Size" are always synchronized with "Gland Size" of the same records.

"Re-Calc" Button (Not available)

When "Re-Calc" button is clicked, "Conduit Size" and "Gland Size" are newly selected as per the above-described formulas. This function is used when you change the minimum cable sizes manually.

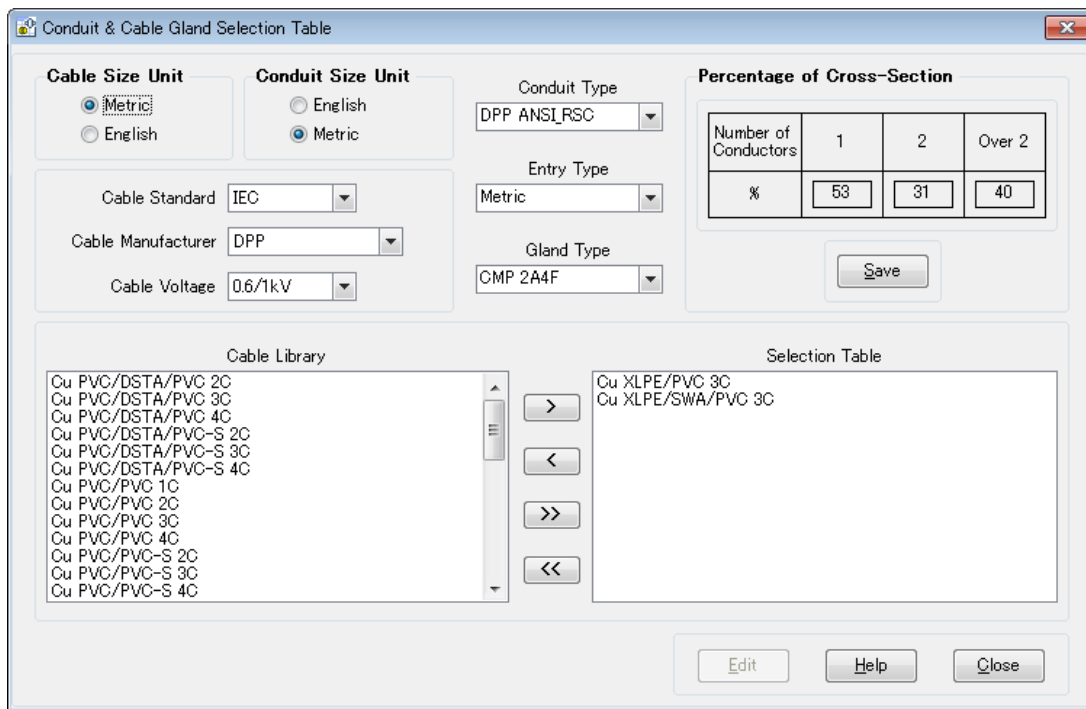
13.8 Conduit and Gland Size Table

The Conduit & Cable Gland Selection Table (hereinafter called "Conduit Selection Table") defines default sizes of conduits, entries and cable glands against each size of power cable and is used for the conduit & cable gland sizing routine. For such, that the detailed procedure is described in **Chapter 13, Cable Management**.

The information similar to this Conduit Selection Table exists in the minimum cable size table **DPPMinCabSize [Conduit Size], [Entry Size] and [Gland Size]** that are indexed by motor output kW and forms a subset of the Conduit Selection Table. The difference between these 2 tables is that whilst the Conduit Selection Table may includes any type and any size of cables used for a project, the minimum cable size table may not.

The table name for the Conduit Selection Table is **DPPCGSelect**.

13.8.1 Entrance Menu



Cable Size Unit

Select Cable Size Unit either "Metric" or "English".

Conduit Size Unit

Select the Conduit Size Unit, "Metric" or "English".

Cable Standard

Select the Cable Standard, IEC, ANSI or JIS.

Cable Manufacturer

The uniquely filtered values of the cable manufacturer field in the cable library appear on the selection box. The default value initially shown is "DPP".

Cable Voltage

The uniquely filtered values of the cable voltage field in the cable library appear on the selection box.

Conduit Type

All the values of the conduit type field in the conduit library appear on the selection box.

Entry Type

The value list for the cable entry type field in the cable gland library is used for selection of this item. ("M", "NPT", "PG", "PF" and "ET")

A default value shown on the box is the previously selected one in "Project Information".

Gland Type

All the values of the cable gland type field in the cable gland library appear on the selection box.

Percent of Cross - Section

Enter the maximum allowable ratios (%) of the cable cross sectional areas against the inner sectional areas of conduit for 3 cases of one, two and more than two conductors installed in a conduit.

Each value has to be within the range of over 0 to 100 (%) (Zero is not allowed.). The default figures shown here are retrieved from NEC (53% for one conductor, 31% for two conductors and 40% for more than two conductors.).

Click the "**Save**" buttons if you wish to save the changes made in the percent of cross section if any.

"Cable Library ⇔ Selection Table"

The cable types in the cable library filtered with the upper parameters are shown on the left-hand selection box. You can select anyone from them to create or add to the Conduit Selection Table and move it to the right-hand selection box showing the present contents of the Conduit Selection Table. When content is removed from the right-hand box, all the corresponding data are deleted from the Conduit Selection Table with a warning message.

13.8.2 Command Buttons

Edit

Click "Edit" button for each cable library placed to the "Selection Table" pane in order for e-DPP to initially perform the conduit and gland sizing (according to the parameters set at the upper half portion of the dialog window) for each cable size belonging to the said cable library. Eventually, e-DPP generates the "Conduit and Gland Selection Table" for that particular cable library. Only one selected item can be edited at a time.

Once the "Edit" button is clicked, another window as shown in the next **Section 10.4.3** will appear. The user can manually modify then the conduit and gland sizes which were initially filled-up by e-DPP program according to his preference.

Note: Clicking the "Edit" button for each new cable library placed in the "Selected Table" pane or already existing but no prior commencement of clicking the "Edit" button yet is a must prior to Conduit and Cable Sizing activity.

Help

Click on "Help" button to open On-Line help file.

Close

Click on "Close" button to close the Conduit and Cable Gland Selection Table Dialog window.

13.8.3 Editor

	Available	Size	Overall Diameter (mm)	Conduit Size			Gland Size	Entry Thread Size	SectArea
				1 Conductor	2 Conductor	3 Conductor			
1	<input checked="" type="checkbox"/>	2.5	12	21	35	35	20	20	2.5
2	<input checked="" type="checkbox"/>	4	13	21	35	41	20	20	4
3	<input checked="" type="checkbox"/>	6	14.5	21	41	41	25	25	6
4	<input checked="" type="checkbox"/>	10	16.5	27	53	53	25	25	10
5	<input checked="" type="checkbox"/>	16	18	27	53	53	25	25	16
6	<input checked="" type="checkbox"/>	25	22	35	63	63	32	32	25
7	<input checked="" type="checkbox"/>	35	24	35	63	78	32	32	35
8	<input checked="" type="checkbox"/>	50	27	41	78	78	40	40	50
9	<input checked="" type="checkbox"/>	70	31	53	91	91	40	40	70
10	<input checked="" type="checkbox"/>	95	35	53	91	103	50S	50	95
11	<input checked="" type="checkbox"/>	120	38	53	103	129	50S	50	120
12	<input checked="" type="checkbox"/>	150	43	63	129	129	50	50	150
13	<input checked="" type="checkbox"/>	185	47	78	129	155	63S	63	185
14	<input checked="" type="checkbox"/>	240	53	78	155	155	63	63	240
15	<input checked="" type="checkbox"/>	300	59	91	155		75S	75	300
16	<input checked="" type="checkbox"/>	400	66	103			75	75	400

Editing the Conduit Selection Table is performed on the above form. The upper area of the form indicates the field contents input in the entrance menu. The lower area indicates the field contents of table **DPPCGSelect**.

Available

This field is linked to the same one of the cable library. Even if this checkbox is unchecked, the Conduit Sizing program regards this cable as target.

Conduit Size - 1 Conductor

When new records are created in **DPPCGSelect** or "Conduit Type" changes from the previous one, the conduit size (record) corresponding to the individual cable size is retrieved as an initial value from the conduit library with the following criteria;

Minimum conduit size (minimum **Inner Diameter**) that satisfies;

$$[\text{Inner Diameter}] **2 \geq [\text{Cable O.D.}] **2 / [\text{Ratio of Cross Section for One Conductor}]$$

When the corresponding record is not found in the cable or conduit library, the conduit size will be left

blank.

If you like to change the calculated conduit sizes, select the other size from the list box.

Conduit Size - 2 Conductors

The following formula is applied:

$$[\text{Inner Diameter}]^{**2} \geq [\text{Cable O.D.}]^{**2} / [\text{Ratio of Cross Section for Two Conductors}]$$

Conduit Size - 3 Conductors

The following formula is applied:

$$[\text{Inner Diameter}]^{**2} \geq [\text{Cable O.D.}]^{**2} / [\text{Ratio of Cross Section for More than Two Conductors}]$$

Gland Size

When new records are created in **DPPCGSelect** or "Gland Type" changes from the previous one, the gland size (record) corresponding to the individual cable size is retrieved as an initial value from the cable gland library with the following criteria;

Minimum gland size (minimum **Cable O.D. Max for Gland**) that satisfies;

$$[\text{Cable O.D. Max for Gland}] \geq [\text{Cable O.D.}]$$

When the corresponding record is not found in the cable or gland library, the gland size will be left blank.

If you like to change the calculated gland sizes, select the other size from the list box.

Entry Thread Size

When new records are created in **DPPCGSelect** or "Entry Type" changes from the previous one, the entry size of gland (record) corresponding to the selected gland type/size and entry type is retrieved as an initial value from the cable gland library.

"Entry Thread Size" is indication only and not editable. Values of "Entry Thread Size" are always synchronized with "Gland Size" of the same records.

<End of Chapter 13>