

# **FineLIFT**

## **Quick Start Guide**

1. Installation – Launching
2. Calculation Environment
3. CAD Component



# Preface

This Quick Start Guide provides a fast and friendly introduction on FineLIFT main features and functionalities. All the features and functions of the program are presented and explained in detail within the complete User's Guide, along with informative examples.

**FineLIFT**, the **F**ully **I**ntegrated **E**nvironment for Elevator Design, combines both designing and calculations in a uniform, integrated environment, consisting of two main Components, the Calculations Component and CAD Component:

- Concerning the **Calculations component**, FineLIFT Calculation Environment performs all the necessary calculations and provides the CAD Environment with all the necessary data needed to create the final drawings of the project with all the construction details. FineLIFT Calculation Environment can also be used independently, providing only the calculations issue of the case study.
- Concerning the **CAD component**, which is based on 4MCAD engine, thus guaranteeing full independency to its user from expensive CAD platforms, provides the user with a friendly CAD environment not only to design the drawings through its rich libraries, but even more to generate completely automatically the drawings of the project, through an expert drawing generator.

Despite its numerous capabilities, FineLIFT has been designed in order to be easy to learn. The simplicity in the operation philosophy is realised very soon and all that the user has to do is to familiarise with the package.

This Guide is divided into 3 short parts:

- Part 1 describes the installation procedure and the main menu structure.
- Part 2 describes the calculation environment, as far as the main data input is concerned.
- Part 3 deals with the CAD component of FineLIFT, showing its philosophy and main features.



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# 1. Installation - Launching

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## 1.1 Installing FineLIFT

For installing FINE LIFT, just follow the instructions given below:

**Insert the CD** of FINE LIFT into the CD-ROM drive (e.g. D:, E:), then the setup window appears on screen.



Then, by pressing the key "Next" and following the instructions, the installation procedure is getting started. After accepting the license agreement and giving user name and organization details.

Installation procedure is finally completed with the following window:



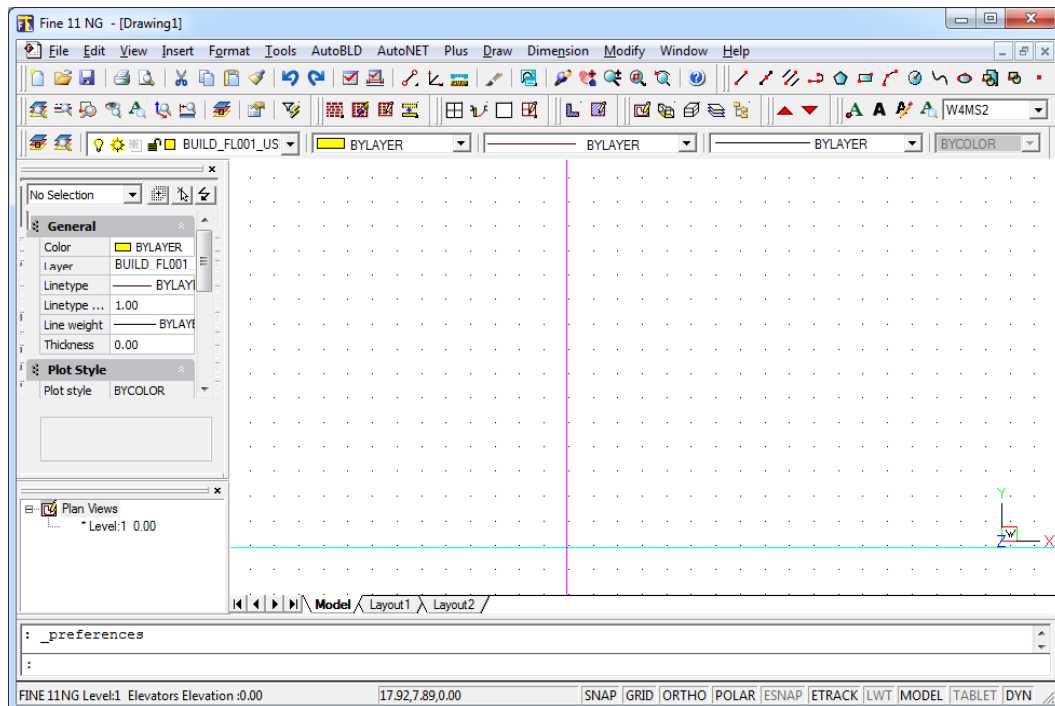
Given that the box "Run FINE 11 NG" is checked, by pressing the "Finish" button, the program runs. Alternatively you can open it through the "Programs" list.

**Caution!** In case you have an edition of the program that uses a usb hasp driver, make sure that the key dongle is plugged into the port of your PC anytime you run the program.



## 1.2 Start Working with FineLIFT

As soon as the program is loaded, the main menu screen appears for the first time:

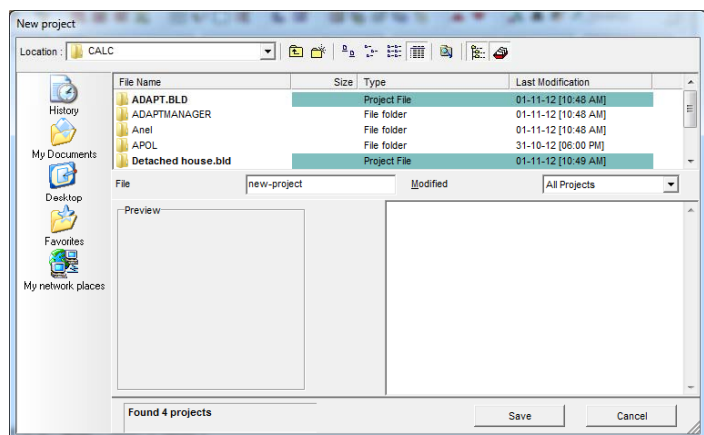


Among the commands of the designing environment, we notice the following main options of the package:

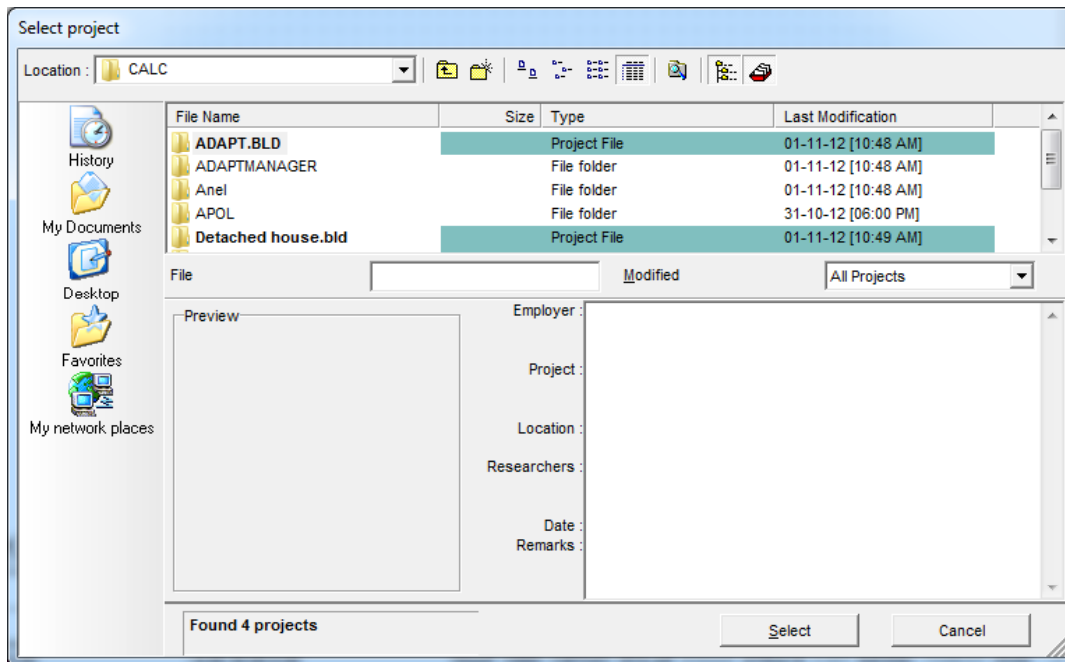
1. Project files management options (New Project, Open Project and Project Information) which are located into the options group **FILE**.
2. Option Group with the name **AutoBLD**, which includes all the commands required for the Architectural designing
3. Option group with the name **AutoNET**, which includes all the commands required for the designing and calculation of the elevators.
4. Auxiliary option group with the name **PLUS**, which contains a series of designing facilities for the user.

## 1.3 Project Definition

To start creating a new project with FINE LIFT, a new project has to be defined by using the corresponding option in the project **FILE** management menu mentioned above. In case that "NEW PROJECT" is selected, a window appears on the screen where the name of the Project should be typed.



In order to open an existing project, created by the program, you select "Select Project". Then a list showing the existing projects in your disk will appear on screen.

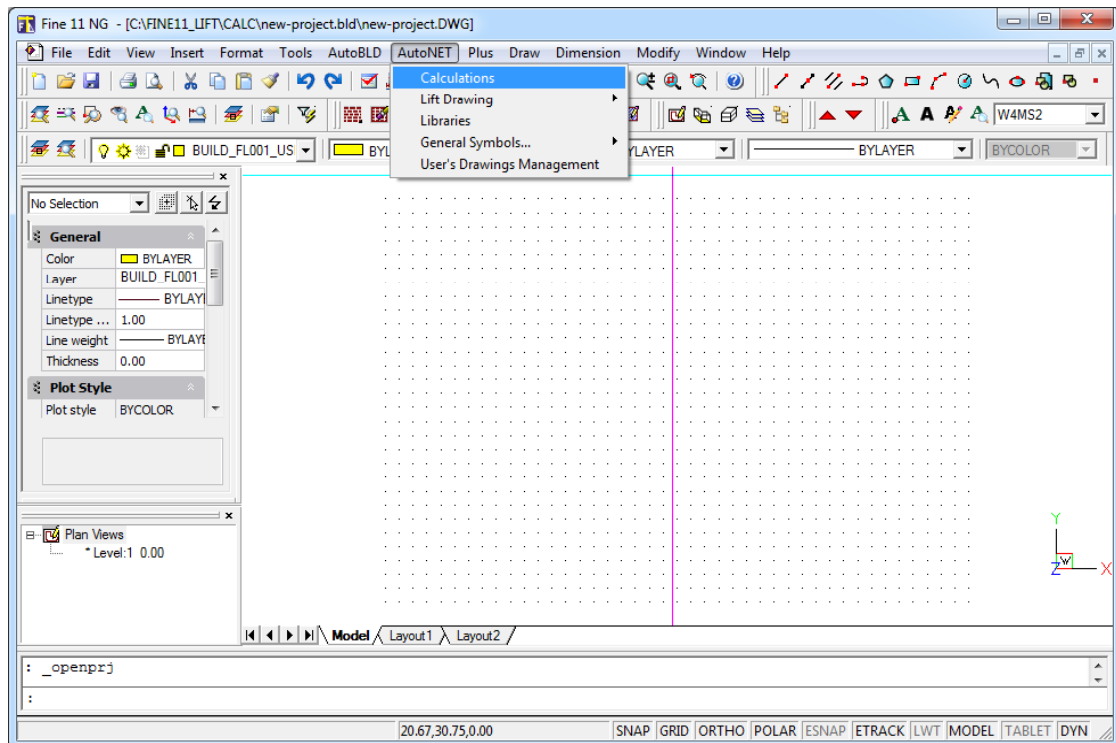


At first, the list displays all the projects that exist in the FINE directory, but with the use of the mouse or the keyboard and acting correspondingly, you can get transferred to any other directory, viewing at the same time the existing projects. It is noted that the projects are included into directories with the extension BLD. If an existing project is selected, it is loaded and displayed on the screen.

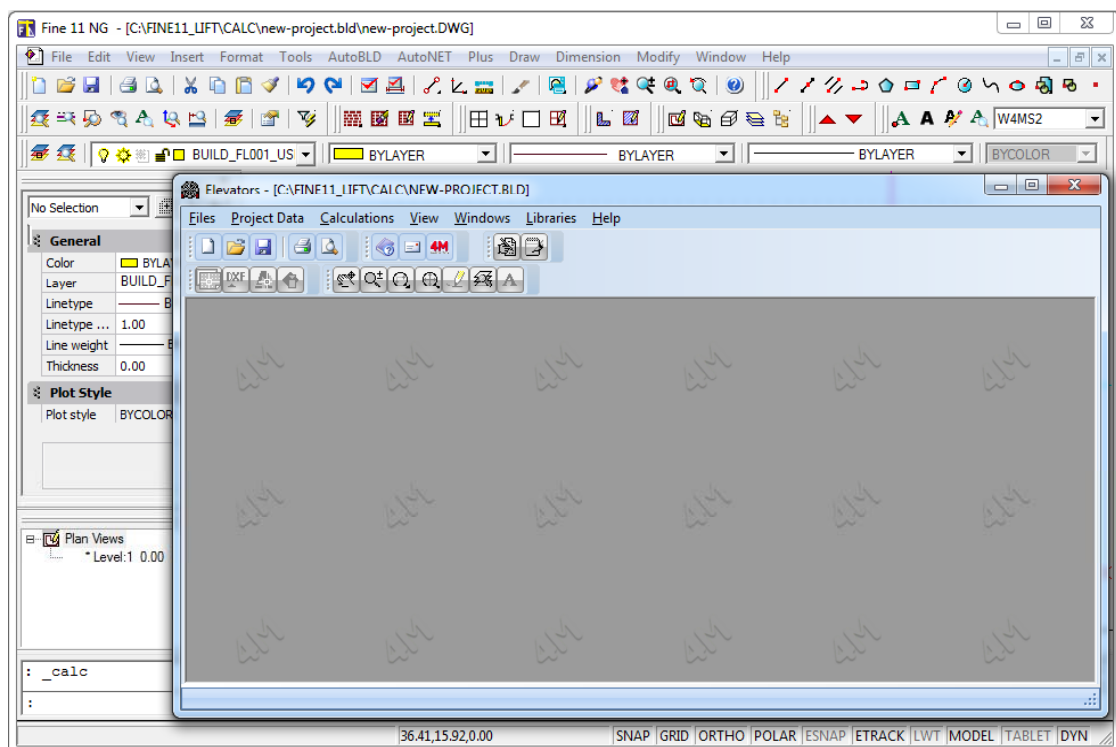
Either if a new project is created or a saved one is loaded, you can now start working with the use of the subsystem commands described above.

**Note:** "Project" is the directory where the project drawings and the calculation files are saved. The program performs an automatic management of the drawing files (based on the main DWG file that has the same name with the project directory) as well as the calculation files. If the user wishes, he may decline from the standard used above and use his own names for each project drawing (e.g. lift construction). This can be accomplished with the "Save As" command and the file will be saved in the project directory (there is no restriction about the number or the type of the characters used for the names of the files). Of course the files defined by the user may be loaded and edited by using the "Open" command. Let us remind you that the "Select Project" command brings up the primary project file which, as mentioned above, has the same name with the project directory.

Most important among the group of commands is the AutoNET group and especially the "Calculations" and "Drawing" commands.



By selecting “Calculations”, the calculation component is being loaded and the following window appears on screen:



Operation instructions of FineLIFT Calculation Environment are given in the chapter 2 that follows.



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## 2. Calculation Environment

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This chapter provides a full description of the Calculation Component of FINE LIFT. Within the basic menu options, we can see the groups **"Files"**, **"Project data"**, **"Calculations"**, **"View"**, **"Windows"**, **"Libraries"** and **"Help"**, which are described below along with their secondary options.

### 2.1 Files

The option "Files" includes all the secondary options needed to manage the project files, to print the output, to communicate with other programs (such as MS-Word) etc. In particular, a short description of those options is given below:

**New project:** Type a name in order to save the new project in a file.

**Project Selection:** A window appears where you can select the desired (existing) project file and load it.

**Caution!** *If neither a new nor an existing Project is selected, the program automatically considers that the UNNAMED project is active. If you add new data to the UNNAMED project and you want to save it with a different name, select "Save as" and type the new project name.*

**Save Project:** The project you are currently working on is saved on the hard disc (with the previously given name).

**Save Project as...:** The project you are currently working on is saved in a different file with a new name.

**Load Prototype:** The saved prototype appears on the screen.

**Save as Prototype:** The form, which has been created by the user and is displayed on the screen, is saved as a Prototype when this option is selected.

**Printing Prototypes:** The printing prototype management window is activated.

**Printing:** The project issue is printed according to the selected options in "Printing Contents" and "Printing Parameters", following the print preview output.

**Printing Contents:** You can select the project items you want to print, as shown in the respective window:

**Printing Parameters:** The desired printing parameters can be selected in this window according to the procedure already mentioned in Chapter 1.

**Print Preview:** The complete project issue appears on the screen, exactly as it will be printed, page to page.

**Export to RTF:** A RTF file containing the project items is created (within the project directory, with the name ANEL.RTF).

**Link to Word:** A word file containing the project items is created (within the project directory, with the name ANEL.RTF). In parallel, the MS-Word program is being activated, given that it is already installed.

**Link to 4M Editor:** A RTF file containing the project items is created (within the project directory, with the name ANEL.RTF). In parallel, the 4M editor program is being activated.

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**Export to pdf:** A PDF file containing the project items is created (within the project directory, with the name ANEL.PDF).

**Exit:** With this command, the application stops running.

## 2.2 Project Data

There are 3 basic data categories of the project: Project info , Traffic Analysis and Specific Data.

### 2.2.1 Project Info

The "Project Info" window includes the project headings where you can type the data concerning the Employer, the Project, the Address, the Date, the Project Managers and Notes, as shown in the respective form.

### 2.2.2 Traffic Analysis

This option is used for the lift traffic design and analysis and is based on Transportation systems in buildings-CIBSE Guide D 2010. The model designed for this purpose uses a calculation method based on mathematical formulae and results in a satisfactory solution for 90-95% of designs. The pure up-peak traffic condition (i.e. only incoming traffic) is used for this method as it provides a well-defined, simple traffic pattern, amenable to mathematical analysis. The practice is to size a lift installation to handle the number of passengers requesting service during the heaviest five minutes of the up-peak traffic condition.

The "Traffic Analysis" window is divided into the "Data" window where the necessary for the calculations data must be entered and the "Results" windows where all the deriving results are shown.

#### 2.2.2.1 Data

**Number of floors N:** The user fills in the number of served floors above the main terminal.

**Number of lifts L:** The number of lifts in the installation is entered in this field.

**Building population U (persons):** The size of the intended population should be obtained, either from the building owner or from the proposed occupier. If the population value is unavailable, by pressing F11 or the button inside this field, a helpful table appears showing the estimation of population for different types of buildings.

**Distance between terminal floors  $D_T$  (m):** This field indicates the total travel from the main terminal to the highest served floor.

**Rated (contract) capacity CC (persons):** The user fill in the manufacturer's guidelines for how much weight a lift can safely carry.

**Rated load Q (or RL) (kg):** The user chooses the appropriate value from a range taken from EN 81-1/2, Table 1.1.

**Maximum car area CA (m<sup>2</sup>):** The maximum car area value results from EN 81-1/2, Table 1.1 according to the previously selected rated load.

**Passenger weight (kg):** This figure represents the average weight of persons in the region where the lift is to be installed. In Europe this is taken in the standards as 75kg, in Singapore 65kg, in Australia 68kg and in Russia 80kg.

A 75kg person is assumed to occupy a floor area of 0.21m<sup>2</sup>, a 65kg person a floor area of 0.18m<sup>2</sup>, a 68kg person a floor area of 0.19m<sup>2</sup> and a 80kg person a floor area of 0.22m<sup>2</sup>. So, the maximum (actual) passenger capacity AC of a lift can be obtained by dividing the maximum car area CA by the occupancy:

$$AC = \frac{CA}{Occupancy}$$

**Rated speed v (m/s):** The user enters the rated speed of the car, which may be provided by the lift installer.

**Caution!** The evaluation of the round trip time assumes that the rated speed is reached in the distance of a single floor jump. Lifts with rated speeds over 1.6 m/s may not reach the rated speed over a typical floor height.

**Single floor flight time  $t_f(1)$  (s):** The user must enter the period of time measured from the instant that the car doors are locked until the lift is level at the next adjacent floor. This value may be provided by the lift installer. If not, the following table is used which indicates some possible values for the assumed values of acceleration/deceleration a, jerk j and three average interfloor distances  $d_f$ .

Single floor flight times					
Rated speed (m/s)	Acceleration (m/s <sup>2</sup> )	Jerk (m/s <sup>3</sup> )	Single floor flight time (s)		
			3.5 m	4.5 m	5.5 m
1.00	0.4-0.7	0.75	6.1	7.1	8.1
1.60	0.7-0.8	0.9	5.2	5.8	6.4
2.50	0.8-0.9	1.0	5.0	5.5	6.0
3.00	1.0	1.25	4.6	5.1	5.6
5.00	1.2	1.5	4.3	4.8	5.2
6.00	1.2	1.8	4.1	4.6	5.0

Alternatively, by pressing F11 or the button inside this field, the user can enter the acceleration a (m/s<sup>2</sup>) and the jerk (m/s<sup>3</sup>) and the single floor flight time  $t_f(1)$  is calculated by using the equations of motion.

The flight time  $t_f(1)$  for a single floor jump if rated speed (symbolized here as  $v_m$ ) is reached instantaneously is given by the following formula:

$$t_f(1) = \frac{d_f}{v_m} + \frac{a}{j} + \frac{v_m}{a}$$

The flight time  $t_f(1)$  for a single floor jump of  $d_f$  if speed (symbolized here as v) is less than rated speed  $v_m$  is given by the following formula:

$$t_f(1) = \frac{a}{j} + \sqrt{\frac{4d_f}{a} + \left(\frac{a}{2j}\right)^2}$$

where  $d_f$  the average interfloor height.

**Door closing time  $t_c$  (s):** The user must enter the period measured from the instant the car doors start to close until the doors are locked. This value may be provided by the lift installer. Otherwise, some typical values appear in a helpful table, which is displayed by pressing F11 or the button inside this field.

**Door opening time  $t_o$  (s):** The user must enter the period measured from the instant the car doors start to open until they are open 800mm. This value may be provided by the lift installer. Otherwise, some typical values appear in a helpful table, which is displayed by pressing F11 or the button inside this field.

**Passenger transfer time  $t_p$  (s):** The user must enter the average period of time for a single passenger to enter or leave a lift car. Otherwise, some typical values for offices appear in a helpful table, which is displayed by pressing F11 or the button inside this field.

**Advanced door opening time  $t_{ad}$  (s):** The user must enter the period from the time the lift is level at a landing until the doors are 800mm open. This value may be provided by the lift installer. Otherwise, assume 1.0s.

**Start delay  $t_{sd}$  (s):** The user must enter the start delay time. This value may be provided by the lift installer. Otherwise, assume 0.5s.

**Desirable number of passengers  $P$  (people):** The user fills up the desirable average number of passengers, which is not necessarily an integer number. Otherwise, he may choose from a helpful table, which is displayed by pressing F11 or the button inside this field.

**Number of passengers  $P$  (people):** For the calculation of round trip time, the average number of passengers in the car  $P$  should be taken as 80% of the maximum actual car capacity  $AC$ . If the desirable average number of passengers is not completed, it is being calculated by the following formula:

$$P = 0.8 * AC$$

**Desirable interval UPPINT (s):** The user fills up the desirable up-peak interval.

**Caution!** The desirable interval cannot have a value greater than the calculated value. The value of the interval should be small in order to achieve a better quality of service. Also, although the user may enter an integer number, the program may provide a slightly different number (the fault is 0.01) with two decimal digits for calculation purposes.

**Interval UPPINT (s):** This calculated value- the up-peak interval- represents the average time between successive car arrivals at the main terminal (or other defined) floor with cars assumed to be loaded to 80% of actual capacity during the up-peak traffic condition. It can be calculated by dividing the round trip time  $RTT$  by the number of lifts  $L$  in the installation. If the desirable average number of passengers is not completed, it can be calculated by dividing the round trip time  $RTT$  by the number of lifts  $L$  in the installation:

$$UPPINT = \frac{RTT}{L}$$



**Note:** In an installation of only one car, the up-peak interval (UPPINT) is equal to the round trip time (RTT).

The round trip time  $RTT$  is defined as the time, in seconds, that it takes for a single lift to make a round trip around a building during the up-peak traffic condition. It is given by the following formula (Barney and Dos Santos, 1975):

$$RTT = 2 * H * t_v + (S + 1) * (T - t_v) + 2 * P * t_p$$

where  $H$  the average highest reversal floor which is calculated by the following formula:

$$H = N - \sum_{i=1}^{N-1} \left( \frac{i}{N} \right)^P$$



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where N the number of floors

$t_v$  the floor transit time (s), which is the time to transit two adjacent floors at rated speed and is given by:

$$t_v = \frac{d_f}{v}$$

where  $d_f$  the average interfloor distance (m), given by  $d_f = \frac{D_T}{N}$

and  $v$  the rated speed (m/s)

S the average number of stops which is calculated by the following formula:

$$S = N * \left( 1 - \left( 1 - \frac{1}{N} \right)^P \right)$$

where N the number of floors

T the performance or “door to door” time (s), which is the period between the instant the car doors begin to close until the instant the car doors are open 800 mm at the next adjacent floor. This parameter of time is calculating by using the following formula, the addends of whom are explained in detail above:

$$T = t_f(1) + t_{sd} + t_c + t_o - t_{ad}$$

P the number of passengers (persons)

$t_p$  the passenger transfer time (s)



**Note:** A number of assumptions are made in order to derive the round trip time equation.

1) The passengers arrive uniformly in time at a lift system for transportation, according to a rectangular probability distribution function (PDF).

2) In the round trip time calculation, the lifts are assumed to fill to 80% of the actual capacity.

3) All floors of the building are equally populated.

4) The rated speed is reached in a single floor jump.

5) The interfloor heights are equal.

**Desirable percentage population %POP (%):** The user fills up the desirable percentage population.

**Caution!** Although the user may enter an integer number, the program may provide a slightly different number (the fault is 0.01) with two decimal digits for calculation purposes.

**Percentage population %POP (%):** The percentage of building population that can be handled is obtained by dividing the up-peak handling capacity (UPPHC) value by the building's effective population U:

$$\%POP = \frac{UPPHC * 100}{U}$$

where UPPHC the up-peak handling capacity (person/5-minutes). This value indicates the number of passengers that a lift system can theoretically transport during the up-peak traffic condition with a car occupancy of 80% of the

AC and it is given by: 
$$UPPHC = \frac{300 * P}{UPPINT}$$

where P the number of passengers (persons) and

UPPINT the up-peak interval (s)

U the building population (persons)

**Quality of service (based on interval):** The up-peak interval UPPINT can be used as a quality indicator. The following table indicates a relationship between quality of service and up-peak interval:

Probable quality of service in office buildings	
Interval (s)	Quality of service
<20	Excellent system
25	Very good system
30	Good system
40	Poor system
>50	Unsatisfactory system

**Quality of service (based on performance time):** The quality of service may, also, be judged by the value selected for performance time T. The following table gives the values of T for an interfloor height  $d_f$  of 3.5m, which can indicate the probable performance of an installed lift system.

Performance time T as an indicator of quality service	
Value of T(s)	Comment
8.0-9.0	Excellent system
9.0-10.0	Good system
10.0-11.0	Average system
11.0-12.0	Poor system
>12.0	Consider system replacement



**Note:** The user can affect the quality of service by changing the different parameters of the “Data” window but especially when entering a desirable value either of the number of passengers or of the interval or of the percentage population.

**Caution!** For example, the user desires to have a percentage population with a value greater than the calculated one. According to the calculations that are being conducted, the values of the number of passengers and the interval are increasing too. If the user sets a desirable interval with a value less than the previously calculated one, then the calculations force the number of passengers to decrease and this will not provide the user with a solution. So the desirable interval and the desirable percentage population (if both exist), should follow the same direction, either increase or decrease their value.

Example:

Initial values:  $P=9.14$ ,  $UPPINT=29.84$ ,  $POP\%=12.26$

Desirable value:  $POP\%=20$

Results for  $POP\%=20$ :  $P=20.53$ ,  $UPPINT=41.08$

Desirable value:  $POP\%=20$  and  $UPPINT=30$

Results for  $POP\%=20$  and  $UPPINT=30$ : A value is not calculated.

### 2.2.2.2 Results

When the fields in “Data” window have been filled in, the results are shown in the “Results” window:

**Maximum car area CA (m<sup>2</sup>)**

**Number of passengers P (people)**

**Interfloor distance  $d_f$  (m)**

**Floor transit time  $t_v$  (s)**

**Highest reversal floor H**

**Number of stops S**

**Performance time T (s)**

**Round trip time RTT (s)**

**Interval UPPINT (s)**

**Up-peak handling capacity UPPHC (person/5-minutes)**

**Occupancy (m<sup>2</sup>)**

**Actual car capacity AC (people)**

**Passenger average waiting time AWT (s):** The calculated value is the average period of time when a passenger either registers a landing call, or joins a queue, until the responding lift begins to open its doors at the boarding floor. For passenger loads P from 50% to 80% of rated capacity CC, AWT is given by:

$$AWT = [0.4 + (1.8 * \frac{P}{CC} - 0.77)^2] * UPPINT$$

For car loads less than 50%, AWT is 40% of the up-peak interval UPPINT. Car loads above 80% are not considered.

**Stopping time  $t_s$  (s):** The stopping time is a composite time associated with each stop and is given by the following formula:

$$t_s = t_f(1) + t_o + t_c - t_v$$

**Passenger average transit time ATT (s):** ATT is the average period of time from when a responding lift begins to open its doors at the boarding floor until the doors begin to open again at the destination floor and is calculated by:

$$ATT = 0.5 * H * t_v + 0.5 * S * t_s + 1.5 * P * t_p$$

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**Passenger average travel time to destination ATTD (s):** It represents the average period of time from when a passenger either registers a landing call, or joins a queue, until the responding lift begins to open its doors at the destination floor. The following formula is followed:

$$ATTD = 0.5 * H * t_v + 0.5 * S * t_s + 1.5 * P * t_p + AWT$$

**Percentage population %POP (%)**

**Quality of service (based on interval)**

**Quality of service (based on performance time)**

## 2.2.3 Specific Data

The specific data that must be entered according to a specific project, are divided into three categories: “General”, “Technical” and “Electric” or “Hydraulic” (according to the choice of the lift type).

### 2.2.3.1 General

**Type of lift:** Choose whether the lift is a Electric (simple or MRL) or Hydraulic (simple or MRL).

**Kind of lift:** Choose the lift kind: Passenger, Hospitals, Vehicles or Goods.

**Number of Passengers:** The number of passengers is completed only when a Passengers lift is selected. For new buildings the minimum number is 8.

**Desirable car area F (m²):** The user fills up the desirable area of the car surface in m².

If a passenger's lift is selected, the user must complete this field only if he desires a different car surface area from the calculated one (Table 1.2 EN 81-1). This area should be smaller than the maximum car surface area given in Table 1.1 EN 81-1. If any of the other lift kinds is selected, the desirable car surface area should definitely be filled up, because it is being used for the calculation of the working load of the lift and the car weight.

**Car area F (m²):** The area of the car that will be used in calculations is shown in m². For Passengers lift it is calculated according to Table 1.2 EN 81-1, if the user has not entered a value for the desirable car area. In the other kinds it is the same with the desirable car area.

**Desirable car weight P (kg):** The user fills up this field when he desires a different car weight from the calculated one.

**Car weight P (kg):** If the desirable car weight is not completed, it is being calculated as follows:

a) Passenger lifts:  $P = 100 + (50 \times \text{Number of passengers})$  (Kg)

b) Other lift kinds:

i)  $Q \leq 500$  Kg:  $P = 100 \times (3 + \text{Car area})$  (Kg)

ii)  $Q > 500$  Kg:  $P = 100 \times [3 + (1.5 \times \text{Car area})]$  (Kg)

Car weight is analysed in the following four fields. Particularly, car weight is equal to the sum of the frame weight, the door weight T1, the door weight T2 and the car (cabin) weight P.

**Carframe weight (kg):** The weight of the frame is indicated.

**Door weight T1 (kg):** The weight of the T1 door is indicated.

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**Door weight T2 (kg):** The weight of the T2 door is indicated.

**Car (cabin) weight P (kg):** The weight of the cabin is indicated. As mentioned above, the sum of these four fields produces the car weight, which is calculated by the program.

**Desirable lift rated load Q (kg):** The user fills in this field if he desires a different lift rated load from the calculated one.

**Lift rated load Q (kg):** Depending on the kind of lift it is calculated as follows:

*a) Passenger lifts:*

i) Number of passengers < 20:  $Q = (75 \times \text{Number of passengers})$  (Kg)

ii) Number of passengers  $\geq 20$ :  $Q = (500 \times \text{Car Area})$  (Kg)

*b) Hospitals lifts:*  $Q = (200 \times \text{Car Area})$  (Kg)

*c) Vehicles lifts:*  $Q = (200 \times \text{Car Area})$  (Kg)

*d) Goods lifts:*  $Q = (300 \times \text{Car Area})$  (Kg)

**Speed (m/s):** The user enters the speed of the car. By pressing F11 or the button inside this field, a helpful table appears showing the suggested lift speeds for different kind of lifts and number of stops.

### 2.2.3.2 Technical

**Number of safety gears:** This field is filled in only when there are more than one safety gears.

**Desirable type of safety gear:** By pressing the button inside the field, the user chooses a different type of the safety gear from the selected one, which is according to the regulations.

**Selected safety gear:** If the desirable type of safety gear field is blank, the safety gear is automatically calculated by the program (according to section 9.8.2 EN 81-1) as follows:

a)  $V_c \leq 0.63$  (m/sec): Instantaneous braking safety gear

b)  $0.63 < V_c \leq 1.00$  (m/sec): Instantaneous braking safety gear with buffered effect

c)  $1.00 < V_c$ : Progressive safety gear

In case we have more than one safety gears, the selected type is the progressive safety gear (Section 9.8.2.2 EN 81-1).

**Machine room location:** Choose whether the machine room is on the up side or the down side of the well.

**Car travel length Lg (m):** Enter the respective length.

**Shaft pit (m):** Enter the shaft depth which the distance between the floor and the shaft end floor.

**Overhead (m):** Enter the height of the highest floor (the distance from the last stop's floor to the inner shaft slab).

**Reeving factor Cm:** Choose "Direct" if the suspension is 1:1 or "Indirect" if the suspension is 2:1

**Number of stops:** Enter the number of stops of the lift.

**Two-speed lift:** The field is checked if we have a two-speed lift or left blank if it has only one speed.

**Number of guide rails:** Choose the number of guide rails that will be used for the car guidance. Valid values are 2 or 4 guide rails.

**Forklift truck loading:** Choose whether the lift will be loaded with a forklift truck. This affects the calculation of the  $F_s$  force which consequently affects the calculation of the bending stress.

**User definition of load position in the car:** Check the box if you wish to enter the position  $x_p$  and  $y_p$  of the load in the calculation of the guide rails or leave it blank and the position of the load will be calculated according to EN 81-1. There are two cases: 1/8 load transportation on x axis and 1/8 load transportation on y axis.



**Note:** Whilst loading or unloading a car, a force on the sill-  $F_s$ -has to be assumed to act centrally on the sill of the car entrance. The amount of the force on the sill shall be:

$F_s = 0,4 * g_n * Q$  for lifts with rated load less than 2500 Kg in private premises, office buildings, hotels, hospitals, etc,

$F_s = 0,6 * g_n * Q$  for lifts with rated loads of 2500 Kg or more,

$F_s = 0,85 * g_n * Q$  for lifts with rated loads of 2500 Kg or more in case of forklift truck loading

Applying the force on the sill the car shall be regarded as empty. At cars with more than one entrance the force on the sill needs to be applied at the most unfavourable entrance only.

### 2.2.3.3a Hydraulic

**Number of pistons:** Choose the number of pistons

**Lateral Suspension:** Check the box if the suspension is on a side of the lift or leave it blank if there is no lateral suspension.

**Print calculation of wire ropes:** The user checks this box if he wishes to incorporate the calculations of the wire ropes into the project issue.

**Print calculation of speed regulator:** The user checks this box if he wishes to incorporate the calculations of the speed regulator into the project issue.

**Print calculation of piston-cylinder-supply pipe:** The user checks this box if he wishes to incorporate the calculations of the piston, the cylinder and the supply pipe into the project issue.

**Print calculation of power unit:** The user checks this box if he wishes to incorporate the calculations of the power unit into the project issue.

**Print calculation of guide rails:** The user checks this box if he wishes to incorporate the calculations of the guide rails into the project issue.

**Print calculation of buffer:** The user checks this box if he wishes to incorporate the calculations of the buffer into the project issue.

### 2.2.3.3b Hydraulic MRL

The options are the same as in the “Hydraulic” type of lift, above.

---

### 2.2.3.3c Electric

**Print calculation of guide rails:** The user checks this box if he wishes to incorporate the calculations of the guide rails into the project issue.

**Print calculation of the wire ropes:** The user checks this box if he wishes to incorporate the calculations of the wire ropes into the project issue.

**Print calculation of traction sheave:** The user checks this box if he wishes to incorporate the calculations of the traction sheave into the project issue.

**Print calculation of the motor:** The user checks this box if he wishes to incorporate the calculations of the motor into the project issue.

**Print calculation of speed regulator:** The user checks this box if he wishes to incorporate the calculations of the speed regulator into the project issue.

**Print calculation of buffer:** The user checks this box if he wishes to incorporate the calculations of the buffer into the project issue.

**Print calculation of counterweight guide rails:** The user checks this box if he wishes to incorporate the calculations of the counterweight guide rails into the project issue.

**Existence of deflection pulley:** The user checks this box if there is a deflection pulley.

### 2.2.3.3d Electric MRL

When the Electric MRL lift type has been selected, in this window the options are the same as the "Electric" lift, plus the two that follow:

**Chassis suspension:** The user selects from the list the type of the chassis suspension.

**Suspension mean:** The user selects whether the suspension will be by wire ropes or by belts.

## 2.3 Calculations

In this option there are 2 different groups of windows depending on the choice of the lift type (Electric or Hydraulic). Therefore, in section 2.3.1 the window's data and results of the electric lift (simple and MRL) are described, whereas in section 2.3.2 the window's data and results of the hydraulic lift (simple and MRL) are described.

### 2.3.1 Electric Lifts EN 81-1

In the following pages the electric lifts EN 81-1 calculation sheets are described along with their corresponding calculations. The data we must fill are presented on the screen with black color and the calculated data with red color.

#### 2.3.1.1 Guide rails

In the dialog screen shown below, we must fill the following data for the calculation of the guide rails:

**Lift rated load Q (kg):** The lift rated load that has been calculated in the "Specific Data" window is shown.

**Car weight P (kg):** The car weight that has been calculated in the "Specific Data" window is shown.

**Auxiliary equipment force M (N):** Enter the force that acts on the guide rails due to the auxiliary equipment, in Newton.

**Impact factor  $k_3$ :** Enter the impact factor  $k_3$  as it is specified from the manufacturer.

**Guide rails material:** Enter the material of the guide rails: St37, St44 or St52.

**Distance between Guide Brackets I (mm):** Enter the distance between guide brackets.

**Car Size on x axis  $D_x$ :** Enter the size of the car on the x axis.

**Car Size on y axis  $D_y$ :** Enter the size of the car on the y axis.

Guide Rails		Ok
Lift Rated Load Q (Kg)	600.00	Cancel
Car Weight P (Kg)	500.00	
Auxillary equipment force M (N)		
Impact Factor $k_3$		Guide Rails
Guide Rails material	St37	
Distance between Guide Brackets I (mm)	1100.00	
Car Size on x axis $D_x$	1400.00	
Car Size on y axis $D_y$	1100.00	
x pos. of carframe center towards guide rail x axis (mm)		
y pos. of carframe center towards guide rail y axis (mm)		
x pos. of suspension towards guide rail x axis $x_s$ (mm)		
y pos. of suspension towards guide rail y axis $y_s$ (mm)		
Des. x pos. of car center towards guide rail x axis $x_c$ (mm)		
Des. y pos. of car center towards guide rail y axis $y_c$ (mm)		
x pos. of car center towards guide rail x axis $x_c$ (mm)	0.00	
y pos. of car center towards guide rail y axis $y_c$ (mm)	0.00	
x pos. of door 1 towards guide rail x axis $x_1$ (mm)	700.00	
y pos. of door 1 towards guide rail y axis $y_1$ (mm)		
x pos. of door 2 towards guide rail x axis $x_2$ (mm)		
y pos. of door 2 towards guide rail y axis $y_2$ (mm)		
x pos. of car center of grav. towards guide rail x axis $x_p$ (mm)	0.00	
y pos. of car center of grav. towards guide rail y axis $y_p$ (mm)	0.00	
Chassis vertical guiding distance h (mm)	2700.00	
Type of Guide Rails	GUIDE RAILS TYPE A/B	
Desirable Guide Rails		
Selected Guide Rails	Nr 5380	
Guide Rails Dimensions	T 50 x 50 x 9	

**X position of carframe center towards guide rail x axis (mm):** Enter the position of the center mass of the carframe towards x axis of the guide rail cross-sectional area.

**Y position of carframe center towards guide rail y axis (mm):** Enter the position of the center mass of the carframe towards y axis of the guide rail cross-sectional area.

**X position of suspension towards guide rail x axis  $x_s$  (mm):** Enter the position of the suspension (S) towards x axis of the guide rail cross-sectional area.

**Y position of suspension towards guide rail y axis  $y_s$  (mm):** Enter the position of the suspension (S) towards y axis of the guide rail cross-sectional area.



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**Desirable x position of car center towards guide rail x axis  $x_c$  (mm):** Enter (if you wish) the distance towards the x axis between the position of the car center and the guide rail x axis.

**Desirable y position of car center towards guide rail y axis  $y_c$  (mm):** Enter (if you wish) the distance towards the y axis between the position of the car center and the guide rail y axis.

**X position of car center towards guide rail x axis  $x_c$  (mm):** The distance towards the x axis between the position of the car center and the guide rail x axis is calculated (if the user hasn't set a desirable one).

**Y position of car center towards guide rail y axis  $y_c$  (mm):** The distance towards the y axis between the position of the car center and the guide rail y axis is calculated (if the user hasn't set a desirable one).

**X position of door 1 towards guide rail x axis  $x_1$  (mm):** Enter (if you wish) the distance towards the x axis between door 1 (opposite to the guide rails) and guide rail x axis.

**Y position of door 1 towards guide rail y axis  $y_1$  (mm):** Enter (if you wish) the distance towards the y axis between door 1 (opposite to the guide rails) and guide rail y axis.

**X position of door 2 towards guide rail x axis  $x_2$  (mm):** Enter (if you wish) the distance towards the x axis between door 2 (next to the guide rails) and guide rail x axis.

**Y position of door 2 towards guide rail y axis  $y_2$  (mm):** Enter (if you wish) the distance towards the y axis between door 2 (next to the guide rails) and guide rail y axis.

**X position of car center of gravity towards guide rail x axis  $x_p$  (mm):** The position of the car center of gravity (P) towards the x axis of the cross section of the guide rail is calculated.

**Y position of car center of gravity towards guide rail y axis  $y_p$  (mm):** The position of the car center of gravity (P) towards the y axis of the cross section of the guide rail is calculated.

**Chassis vertical guiding distance  $h$  (mm):** Enter the distance between the guide rails shoes for the chassis drive.

**Type of guide rails:** Choose the desirable type of guide rails from the guide rails library, by pressing F11 or the button inside the field.

**Desirable guide rails:** By pressing F11 or the button inside the field, it is possible to choose a different size of the selected guide rail type from the one that had been calculated by the program.

By pressing the button "Guide Rails" the following screen appears, which shows the calculated values and the maximum acceptable ones.

Guide Rails - Results			Close
Safety gear - Shift towards X			
Bending Stress	$\sigma_{\text{Bm}}$ (N/mm <sup>2</sup> )	75.66 <= $\sigma_{\text{Bm}} \cdot \text{al} = 205$ .	
Bending and Pressing	$\sigma_{\text{Bp}}$ (N/mm <sup>2</sup> )	113.87 <= $\sigma_{\text{Bp}} \cdot \text{al} = 205$	
Buckling and Bending	$\sigma_{\text{Bc}}$ (N/mm <sup>2</sup> )	153.34 <= $\sigma_{\text{Bc}} \cdot \text{al} = 205$	
Bending Stress of the rail Flange	$\sigma_{\text{BF}}$ (Nt)	31.37 <= $\sigma_{\text{BF}} \cdot \text{al} = 205$ .	
Deflection in the X-axis	$\delta_{\text{X}}$ (mm)	1.38 <= $\delta_{\text{X}} \cdot \text{al} = 5.00$	
Deflection in the Y-axis	$\delta_{\text{Y}}$ (mm)	0.00 <= $\delta_{\text{Y}} \cdot \text{al} = 5.00$	
Safety gear - Shift towards Y			
Bending Stress	$\sigma_{\text{Bm}}$ (Nt/mm <sup>2</sup> )	61.09 <= $\sigma_{\text{Bm}} \cdot \text{al} = 205$ .	
Bending and Pressing	$\sigma_{\text{Bp}}$ (Nt/mm <sup>2</sup> )	99.30 <= $\sigma_{\text{Bp}} \cdot \text{al} = 205$ .	
Buckling and Bending	$\sigma_{\text{Bc}}$ (Nt/mm <sup>2</sup> )	140.23 <= $\sigma_{\text{Bc}} \cdot \text{al} = 205$	
Bending Stress of the rail Flange	$\sigma_{\text{BF}}$ (Nt)	0.00 <= $\sigma_{\text{BF}} \cdot \text{al} = 205.0$	
Deflection in the X-axis	$\delta_{\text{X}}$ (mm)	0.00 <= $\delta_{\text{X}} \cdot \text{al} = 5.00$	
Deflection in the Y-axis	$\delta_{\text{Y}}$ (mm)	0.85 <= $\delta_{\text{Y}} \cdot \text{al} = 5.00$	
Normal use - Running - Shift towards X			
Bending Stress	$\sigma_{\text{Bm}}$ (Nt/mm <sup>2</sup> )	18.16 <= $\sigma_{\text{Bm}} \cdot \text{al} = 165$ .	
Bending Stress of the rail Flange	$\sigma_{\text{BF}}$ (Nt)	7.53 <= $\sigma_{\text{BF}} \cdot \text{al} = 165.0$	
Deflection in the X-axis	$\delta_{\text{X}}$ (mm)	0.33 <= $\delta_{\text{X}} \cdot \text{al} = 5.00$	
Deflection in the Y-axis	$\delta_{\text{Y}}$ (mm)	0.00 <= $\delta_{\text{Y}} \cdot \text{al} = 5.00$	
Normal use - Running - Shift towards Y			
Bending Stress	$\sigma_{\text{Bm}}$ (Nt/mm <sup>2</sup> )	14.66 <= $\sigma_{\text{Bm}} \cdot \text{al} = 165$ .	
Bending Stress of the rail Flange	$\sigma_{\text{BF}}$ (Nt)	0.00 <= $\sigma_{\text{BF}} \cdot \text{al} = 165.0$	
Deflection in the X-axis	$\delta_{\text{X}}$ (mm)	0.00 <= $\delta_{\text{X}} \cdot \text{al} = 5.00$	
Deflection in the Y-axis	$\delta_{\text{Y}}$ (mm)	0.20 <= $\delta_{\text{Y}} \cdot \text{al} = 5.00$	
Normal Use - Loading			
Bending Stress	$\sigma_{\text{Bm}}$ (Nt/mm <sup>2</sup> )	24.21 <= $\sigma_{\text{Bm}} \cdot \text{al} = 165$ .	
Bending Stress of the rail Flange	$\sigma_{\text{BF}}$ (Nt)	10.04 <= $\sigma_{\text{BF}} \cdot \text{al} = 165$ .	
Deflection in the X-axis	$\delta_{\text{X}}$ (mm)	0.44 <= $\delta_{\text{X}} \cdot \text{al} = 5.00$	
Deflection in the Y-axis	$\delta_{\text{Y}}$ (mm)	0.00 <= $\delta_{\text{Y}} \cdot \text{al} = 5.00$	

### 2.3.1.2 Wire Ropes – Traction sheave

The following fields must be completed for the calculation of the wire ropes and the traction sheave:

**Desirable counterweight weight (Kg):** Enter (if you wish) the weight of the counterweight. The calculated value is shown in the next field.

**Number of traction wire ropes (n):** Enter the number of wire ropes used for the traction of the lift's car. It should always be more than two.

**Existence of:** Choose the existence of «Wire Rope», «Drum» or «Suspension Chain».

**Type of wire ropes:** By pressing F11 or the button inside the field, choose the desirable type of wire ropes from the wire ropes library.

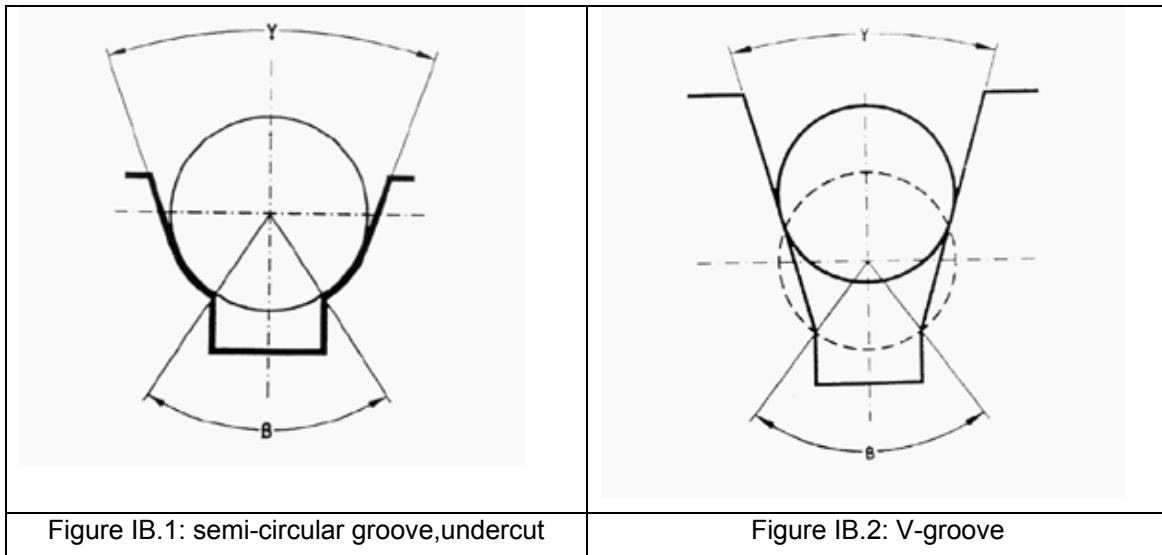
**Desirable wire ropes diameter d (mm):** By pressing F11 or the button inside the field, you can choose from the wire ropes library (if you wish) a different wire ropes diameter from the one selected by the program. The calculated value is shown in the next field.

When the above cells have been filled in, the **wire ropes diameter** and **weight** and the **breaking load** are calculated.

**Weight of travelling cable per meter (kg/m):** You fill in the weight of the travelling cable per meter.

Wire Ropes-Traction Sheave	
Desirable counterweight weight (Kg)	0.00
Counterweight weight G (Kg)	800.00
Number of Traction Wire Ropes (n)	4
Existence of	Wire rope
Type of Wire Ropes	METALCAVI
Desirable Wire Ropes Diameter d (mm)	
Wire Ropes Diameter d (mm)	8.00
Weight of Wire Ropes Pwrp. (Kg)	10.58
Wire Ropes Breaking Load Fg (Kg)	3490.00
Weight of travelling cable per meter (Kg/m)	0.30
Kind of Pulley	V-groove hardened, without undercut
Angle of Wrap of the Wire Ropes on the Traction Sheave alpha (°)	180.00
Undercut angle beta (°)	97.00
Groove angle gamma (°)	38.00
Braking acceleration gammapi (m/sec²)	0.50
Number of pulleys with simple bends Nps	1
Number of pulleys with reversed bends Npr	
Desirable deflection pulley diameter Dp (mm)	
Selected deflection pulley diameter Dp (mm)	320.00
Desirable traction sheave diameter Dt (mm)	
Selected traction sheave diameter Dt (mm)	480.00
Wire ropes Actual Traction during car loading	2.62
Wire ropes Required Traction during car loading	1.58
Wire ropes Actual Traction during emergency braking	2.48
Wire ropes Required Traction during emergency braking, full load, car down	1.54
Wire ropes Required Traction during emergency braking, empty car up	1.78
Wire ropes Actual Traction while car is stalled	6.89
Wire ropes Required Traction while car is stalled	47.59
Wire ropes safety factor limit Sf	12.25
Wire ropes safety factor $\gamma \geq (12.25)$	12.57

**Kind of pulley:** Choose whether the traction sheave is semi-circular groove with undercut or semi-circular groove or V groove or V groove hardened, without undercut.



**Angle of wrap of the wire ropes on the traction sheave  $\alpha$  (°):** If you wish you can change the default value. Allowable values are between  $150^\circ$  and  $220^\circ$ .

**Undercut angle beta  $\beta$  (°):** The undercut angle value is indicated. The angle must be smaller than  $106^\circ$ .

**Groove angle gamma  $\gamma$  (°):** The groove angle value is indicated. The minimum value of the angle is  $25^\circ$ .

**Braking acceleration gammapi  $\gamma\pi$  (m/sec²):** Under no circumstances should the acceleration be smaller than:

- 0,5 m/s<sup>2</sup> for normal case
- 0,8 m/s<sup>2</sup> when reduced stroke buffers are used.

**Number of pulleys with simple bends Nps:** Enter the appropriate number of pulleys.

**Number of pulleys with reverse bends Npr:** Enter the appropriate number of pulleys.

**Desirable deflection pulley diameter D<sub>p</sub> (mm):** Enter the desirable diameter of the pulley.

**Attention!** This field will be shown only if the respective box is checked in the lift's specific data.

**Desirable traction sheave diameter D<sub>t</sub>:** The user enters the desirable diameter of the traction sheave if he desires a different diameter from the one selected by the program, which is shown in the next field.

When the above fields have been filled in, the results are shown below in red color:

**Wire ropes actual traction during car loading**

**Wire ropes required traction during car loading**

**Wire ropes actual traction during emergency braking**

**Wire ropes required traction during emergency braking, full loads, car down**

**Wire ropes required traction during emergency braking, empty car up**

**Wire ropes actual traction while car is stalled**

**Wire ropes required traction while car is stalled**

**Wire ropes safety factor limit Sf**

**Wire ropes safety factor  $v \geq (12.25)$**

### 2.3.1.3 Motor

As shown in the following screen, for the calculation of the required motor power the next fields have to be completed:

Motor		Ok	Cancel
Rated Load Q (Kg)	600.00		
Sum of Carframe and Car Force P (Kg)	500.00		
Counterweight Weight G (Kg)	800.00		
Car Speed Vc (m/s)	0.63		
Reeving Factor Cm	1		
Traction Sheave Efficiency n1	0.80		
Traction Sheave Bearings Efficiency n2	0.70		
Worm Screw Efficiency n3	0.60		
Acting Force F (Kg)	300.00		
Required Motor Power N (HP)	7.50		
Selected Motor			
Motor Power N (HP)	0.00		

The program calculates automatically the following fields (in red color):

---

**Rated load Q (kg)**

**Sum of carframe and car force P (kg)**

**Counterweight Weight G (kg)**

**Car speed V<sub>c</sub> (m/s)**

**Reeving factor C<sub>m</sub>**

The user has to fill in the fields:

**Traction sheave efficiency  $n_1$ :** Enter the efficiency of the traction sheave.

**Traction sheave bearings efficiency  $n_2$ :** Enter the efficiency of the traction sheave bearings.

**Worm screw efficiency  $n_3$ :** Enter the efficiency of the worm screw.

The **acting force** and the **required motor power** are displayed and as soon as the user selects the motor from the **selected motor** field, the **motor power** is displayed.

### **2.3.1.4 Speed regulator**

For the calculation of the speed regulator, the following fields have to be completed:

**Deriving overspeed governor tensioning weight G' (kg):** The user enters the deriving tensioning weight. A typical value is 50 kg.

**Type of overspeed governor pulley:** Choose whether the pulley is semi-circular groove with undercut or semi-circular groove or V groove or V groove hardened, without undercut.

**Undercut angle beta  $\beta$  (°):** The undercut angle value is written. The angle must be smaller than 106°.

**Groove angle gamma  $\gamma$  (°):** The groove angle value is written. The minimum value of the angle is 25°.

**Angle of wrap of the ropes on the overspeed governor pulley alpha'  $\alpha'$  (°):** If you wish you can change the default value. Valid values are between 150° and 220°.

When the above fields have been completed, the **wire ropes-pulley friction coefficient** and the **minimum overspeed governor tripping speed and maximum overspeed governor tripping speed** are calculated.

**Desirable overspeed governor tripping speed V'<sub>des</sub> (m/s):** If you want, you can choose the overspeed governor tripping speed otherwise the program chooses the minimum overspeed governor tripping speed.

Once again, the following results are displayed:

**Tripping speed of an overspeed governor V' (m/s)**

**Wire ropes-pulley friction coefficient f'**

**Required force for safety gear tripping in the upward direction F<sub>eup</sub> (kg)**

**Force on wire rope in the upward direction S<sub>2up</sub> (kg)**

**Required force for safety gear tripping in the downward direction F<sub>ed</sub> (kg)**

**Force on wire rope in the downward direction S<sub>2d</sub> (kg)**

**Number of overspeed governor wire ropes n':** Enter the number of the wire ropes of the overspeed governor.

Speed regulator	
Deriving Overspeed Governor Tensioning Weight G' (Kg)	50.00
Type of Overspeed Governor Pulley	V-groove hardened, without undercut
Undercut Angle beta' (°)	97.00
Groove Angle gamma' (°)	35.00
Angle of Wrap of the Ropes on the Overspeed Governor Pulley alpha' (°)	180.00
Wire Ropes - Pulley Friction Coefficient m'	0.09
Minimum Overspeed Governor Tripping Speed V'min. (m/s)	0.72
Maximum Overspeed Governor Tripping Speed V'max. (m/s)	0.80
Desirable Overspeed Governor Tripping Speed V'd. (m/s)	
Tripping Speed of an Overspeed Governor V' (m/s)	0.72
Wire Ropes - Pulley Friction Coefficient f	0.31
Required Force for Safety Gear Tripping in the upward direction FEup (Kg)	41.22
Force on wire rope in the upward direction S2up (Kg)	66.22
Required Force for Safety Gear Tripping in the downward direction Fed. (Kg)	15.56
Force on wire rope in the downward direction S2d. (Kg)	25.00
Number of Overspeed Governor Wire Ropes (n')	1
Type of Wire Ropes	METALCAVI
Desirable Wire Ropes Diameter d' (mm)	
Wire Ropes Diameter d' (mm)	6.00
Wire Ropes Breaking Load Fg' (Kg)	1980.00
Safety Factor v' >= 8	29.90
Desirable Overspeed Governor Pulley Diameter D' (mm)	
Selected Overspeed Governor Pulley Diameter D' (mm)	180.00
Desirable Tensioning Pulley Diameter Dp' (mm)	
Selected Tensioning Pulley Diameter Dp' (mm)	180.00

**Type of wire ropes:** By pressing F11 or the button inside the field, choose the desirable type of wire ropes from the wire ropes library.

**Desirable wire ropes diameter d' (mm):** By pressing F11 or the button inside the field, choose (if you wish) from the selected wire ropes type library, a different diameter from the one calculated by the program.

The **wire ropes diameter**, **breaking load** and the **safety factor** are displayed.

**Desirable overspeed governor pulley diameter D' (mm):** By pressing F11 or the button inside the field, choose (if you wish) from the pulleys library, a different diameter from the one calculated by the program. The **selected overspeed governor pulley diameter D'** is displayed.

**Desirable tensioning pulley diameter D<sub>p</sub>' (mm):** By pressing F11 or the button inside the field, choose (if you wish) from the pulleys library, a different diameter from the one calculated by the program. The **selected tensioning pulley diameter D<sub>p</sub>'** is displayed.

### 2.3.1.5 Buffer

The program calculates automatically the following fields (in red color):

**Rated load Q (kg)**

**Sum of carframe and car force P (kg)**

**Overspeed governor counterweight weight G'(kg)**

**Car speed Vc (m/s)**

For the calculation of the buffers, the following data must be entered:

**Number of car buffers:** The number of buffers shall be filled.

**Desirable type of buffers:** By pressing F11 or the button inside the field, you can choose (if you wish) from a number of buffer types, a different type from the one selected by the program.

Buffer	
Rated Load Q (Kg)	600.00
Sum of Carframe and Car Force P (Kg)	500.00
Overspeed Governor Counterweight Weight G' (Kg)	50.00
Car Speed Vc (m/s)	0.63
Number of Car Buffers	1
Desirable Type of Buffers	
Selected Type of Buffers	Energy accumulation type with linear characteristi
Minimum Required Travel Height S (mm)	65.00
Minimum Static Load per Car Buffer (Kg)	2776.45
Maximum Static Load per Car Buffer (Kg)	4442.32

Buttons: Ok, Cancel

The choices appearing in the “Desirable buffers type” are the following:

- Energy accumulator type with linear characteristics
- Energy accumulator type with non linear characteristics
- Energy accumulator type with buffer return movement
- Energy dissipation type

The following results are displayed:

#### **Selected type of buffers**

**Minimum required travel height S (mm)**

**Minimum static load per car buffer (kg)**

**Maximum static load per car buffer (kg)**

#### **2.3.1.6 Counterweight guide rails**

The following data must be completed for the calculation of the counterweight guide rails:

**Number of counterweight guide rails  $n_g$ :** Enter the counterweight’s guide rails number of the lift. A common value is 2.

**Number of counterweight safety gears:** Enter the counterweight’s safety gears. A common value is 1.

Counterweight Guide Rails		Ok
Counterweight Weight G (Kg)	800.00	Cancel
Number of Counterweight Guide Rails ng	2	
Number of Counterweight Safety Gears	1	
Desirable Type of Counterweight Safety Gear		
Selected Counterweight Safety Gear		
Distance bet. Counterweight Guide Brackets lg (mm)	1100.00	
Guide Rails Material	St37	
Type of Counterweight Guide Rails	GUIDE RAILS TYPE A/B	
Desirable Counterweight Guide Rails		
Counterweight eccentricity towards X axis (mm)	15.00	
Counterweight eccentricity towards Y axis (mm)	25.00	
Counterweight vertical guiding distance hg (mm)	2700.00	
Selected Guide Rails	Nr 5380	
Guide Rails Dimensions	T 50 x 50 x 9	
Slenderness ratio lamda	114.46	
Buckling Value omega	2.23	
Counterweight Buckling Force Fg (N)	0.00	
Counterweight Buckling Stress sigmak <= ( 205.0 N/mm²)	0.00	

**Desirable type of counterweight safety gear:** By pressing F11 or the button inside the field, choose the desirable type for the counterweight safety gear.

If this field is left blank the double direction safety gear is chosen and is not subject to buckling check.

**Distance between counterweight guide brackets lg (mm):** Enter the distance between guide brackets of the counterweight.

**Guide rails material:** Choose from the list shown the desirable material of the guide rails.

**Type of counterweight guide rails:** The desirable type of the counterweight guide rails is chosen from the library.

**Desirable counterweight guide rails:** By pressing F11 or the button inside the field, the type of the counterweight guide rails of our choice is selected.

**Counterweight eccentricity towards X axis (mm):** Counterweight's mass position in relation to guide rail's x axis.

**Counterweight eccentricity towards Y axis (mm):** Counterweight's mass position in relation to guide rail's y axis.

**Counterweight vertical guiding distance hg (mm):** Enter the distance between the guide rails shoes.

## 2.3.2 Hydraulic Lifts EN 81-2

Hydraulic lifts are divided into the following categories according to their suspension type:

### 1. HAI

One back or side piston, indirect drive through wire ropes

Application for loads from 150 to 1.800 kg

Application for drive lengths from 4.0 to 35.0 m



## 2. HAS

One back or side piston, direct drive

Application for loads from 150 to 1.800 kg

Application for drive lengths from 2.5 to 8.0 m

## 3. HA

One piston below, direct drive

Application for loads from 225 to 6.000 kg

Application for drive lengths from 2.5 to 15.0 m

## 4. HAD

Two side pistons, direct drive

Application for loads from 750 to 12.000 kg

Application for drive lengths from 2.5 to 8.0 m

## 5. HADI

Two side pistons, indirect drive through wire ropes

Application for loads from 750 to 6.000 kg

Application for drive lengths from 4.0 to 35.0 m

Suspension type defines the calculations and checks type that will be executed by the program.

Within the User's Guide, the relevant calculation sheets along with the calculations executed in the case of hydraulic lifts are described in detail. In particular, all the parameters involved in the calculations are numerated and the principles, on which the calculations are based, are analysed. The logical order followed by the program is exactly the same with the one that follows.

### 2.3.2.1 Wire ropes-Pulley-Pulley axis

For the calculation of the pulley wire rope and the pulley axis the following data must be completed, as shown in the next dialog screen.

Wire Ropes	
Rated Load Q (Kg)	600.00
Sum of Carframe and Car Force P (Kg)	500.00
Reeving Factor Cm	2
Number of Traction Wire Ropes (n)	4
Type of Wire Ropes	METALCAVI
Desirable Wire Ropes Diameter d (mm)	
Wire Ropes Diameter d (mm)	8.00
Wire Ropes Breaking Load Fg (Kg)	3490.00
Safety Factor $\nu \geq (12.00)$	12.50
Desirable Pulley Diameter D (mm)	
Selected Pulley Diameter D (mm)	320.00
Pulley Force (Weight) Prh (Kg)	45.00
Pulley Axis Material	St44
Desirable Pulley Axis Diameter da (mm)	
Selected Pulley Axis Diameter da (mm)	40.00
Pulley Axis Moment of Resistance W (mm <sup>3</sup> )	6280.00
Pulley Axis Stress Lever Arm C (mm)	35.00
Axis Stress $\sigma \leq 91.7$ (Nt/mm <sup>2</sup> )	62.60

Ok  
Cancel

**Number of traction wire ropes:** Enter the number of the traction wires ropes of the lift. It should always be more than two.

**Type of wire ropes:** By pressing F11 or the button inside the field, choose the desirable type of wire ropes from the wire ropes library.

**Desirable wire ropes diameter:** By pressing F11 or the button inside the field, you can choose (if you wish) a different diameter from the one selected by the program through the selected wire ropes type library.

The **wire ropes diameter**, **breaking load** and the **safety factor** are displayed.

**Desirable pulley diameter D:** By pressing F11 or the button inside the field, you can choose (if you wish) a different diameter from the one chosen by the program through the pulleys library. The **selected pulley diameter D** is displayed.

The **pulley force (weight) Prh** is displayed.

**Pulley axis material:** Choose the material of the pulley axis: St37, St 44 or St52.

**Desirable pulley axis diameter da:** By pressing F11 or the button inside the field, you can choose (if you wish) a different diameter from the one selected by the program through the pulleys library. The **selected pulley axis diameter da** is displayed.

The following results are displayed:

**Pulley axis moment of resistance W (mm<sup>3</sup>)**

**Pulley axis stress lever arm C (mm)**

**Axis stress sigma (Nt/mm<sup>2</sup>)**

### 2.3.2.2 Piston-Cylinder-Supply Pipe

As shown on the respective dialog, the following data must be completed for the calculation of the piston, the cylinder and the supply pipe:

Piston - Cylinder - Supply Pipe	
Rated Load Q (Kg)	600.00
Sum of Carframe and Car Force P (Kg)	500.00
Pulley Force (Weight) Prh (Kg)	45.00
Car Speed Vc (m/s)	0.63
Reeving Factor Cm	2
Car Travel Height Lg (m)	11.50
Desirable Piston Length L (m)	
Piston - Cylinder material	St52
Supply Pipe Material	Elastic
Type of Supply Pipe	ELASTIC PIPE, HIGH PRESSURE
Desirable out. diameter of supply pipe (mm)	
Piston - Cylinder Supplier	WIKAR
Desirable Type of Piston	
External guiding	NO
Selected Type of Piston	90 x 7
Piston Length L (m)	6.25
Critical Buckling Load Fcr.1 (N)	41197
Piston Buckling Load Fs1 (N) <= Fcr.1	32021
Static Operating Pressure P1stat. (N/mm <sup>2</sup> )	3.66
Permissible Stress of Piston Walls Pstat.pl. (N/mm <sup>2</sup> )	13.11
Permissible Stress of Cylinder Walls Pstat.cyl. (N/mm <sup>2</sup> )	5.00
Permissible Stress of Supply Pipe Walls Pstat.du. (N/mm <sup>2</sup> )	42.00
Permissible Stress of Cylinder Bottom Pstat.bas. (N/mm <sup>2</sup> )	33.10
Permissible Groove Stress of Cylinder Bottom Pstat.bas. (N/mm <sup>2</sup> )	9.88

**Desirable piston length L (mm):** Enter the length of the piston.

**Piston – cylinder material:** Choose whether the piston and the cylinder material are St37, St44 or St52.

**Supply pipe material:** Choose whether the material of the supply pipe is St37, St44, St52 or elastic.

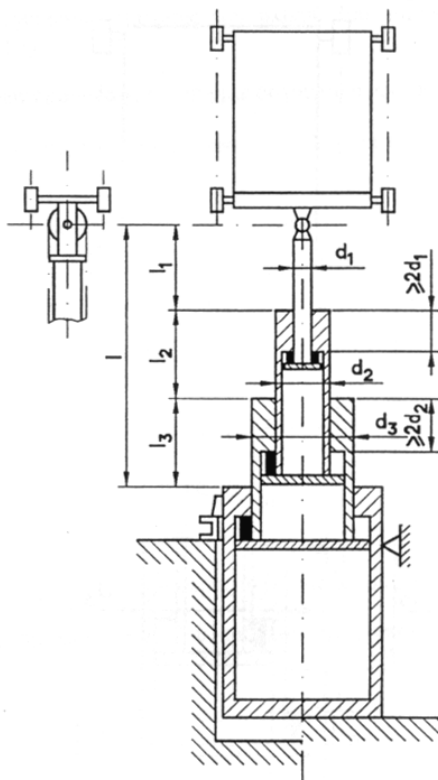
**Type of supply pipe:** By pressing F11 or the button inside the field, choose from the supply pipes library the desirable type of supply pipe.

**Desirable outer diameter of supply pipe:** The outer diameter of the supply pipe, which is chosen by the user, is shown in mm.

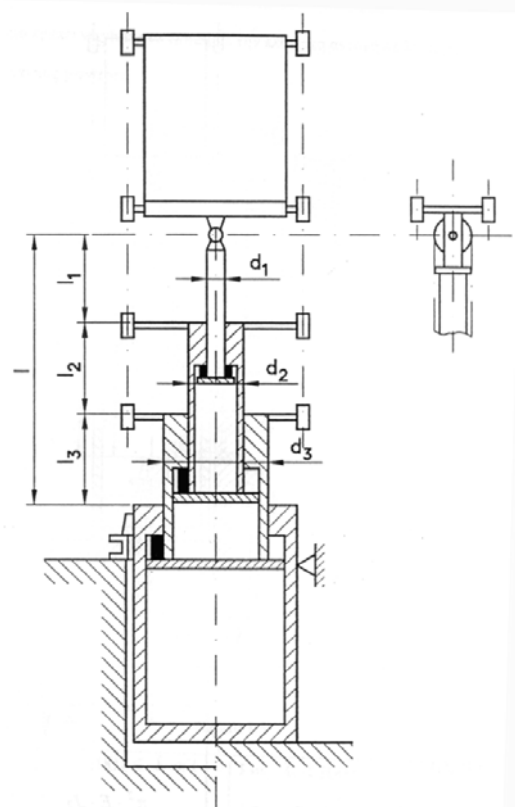
**Piston – cylinder supplier:** By pressing F11 or the button inside the field choose the desirable supplier of the piston-cylinder from the piston-cylinder library.

**Desirable type of piston:** By pressing F11 or the button inside the field, choose the desirable type of piston from the piston library, different from the one chosen by the program when the above field (Piston – cylinder supplier) is completed. The **selected type of piston** is displayed.

**External guiding:** Choose “Yes” or “No” depending on the existence of an external guiding. (Completed only in the case of telescopic pistons).



Telescopic lift units without external guiding



Telescopic lift units with external guiding

By pressing the button “**Piston**” the following window appears with the calculated and the maximum permissible values of the piston.

Piston		Close
Piston tube outer diameter dr1 (mm)	90.00	
Piston tube inner diameter dri1 (mm)	76.00	
Wall thickness of piston tube er1 (mm)	7.00	
Piston stress area A0 (cm²)	63.62	
Piston cross-sectional area A (cm²)	18.25	
Moment of inertia of piston cross-sectional area J (cm⁴)	158.30	
Radius of gyration of piston cross-sectional area i (mm)	29.45	
Piston Weight Pe (Nt)	1071.74	
Piston Buckling Length Lk (m)	6.25	
Slenderness ratio lamda	212.23	
Cylinder tube outer diameter Dk (mm)	127.00	
Cylinder tube inner diameter Dki (mm)	118.00	
Wall thickness of cylinder tube ek (mm)	4.50	
Supply pipe outer diameter Dk (mm)	30.20	
Supply pipe wall thickness es (mm)	5.55	
Permissible Stress of Cylinder Bottom Pstat.alphat (N/mm²)	33.10	
Permissible Groove Stress of Cylinder Bottom Pstat.bas.sh (N/mm²)	9.88	

**Caution!** If no piston is calculated it means that either the selected manufacturer does not have the selected material of the piston (so you have to choose a different manufacturer or piston material eg. St 52) or no piston of the selected manufacturer is sufficient.

The following results are displayed:

**Piston length L (m)**

**Critical buckling load Fcr.1 (N)**

**Piston buckling load Fs1 (N)**

**Static operating pressure P1stat (N/mm²)**

**Permissible stress of piston walls Pstat.pi. (N/mm²)**

**Permissible stress of cylinder walls Pstat.cyl. (N/mm²)**

**Permissible stress of supply pipe walls Pstat.du. (N/mm²)**

**Permissible stress of cylinder bottom Pstat.bas. (N/mm²)**

**Permissible groove stress of cylinder bottom Pstat.bas. (N/mm²)**

### 2.3.2.3 Power unit

The following data have to be completed for the selection of the pump and the motor:

**Selected pump:** By pressing F11 or the button inside the field, you can choose a pump from the pumps library, which has an equal or greater flow rate from the minimum required pump flow rate calculated by the program.

**Selected motor:** By pressing F11 or the button inside the field, you can choose a motor from the motor library, which has an equal or greater nominal power from the minimum required rated power calculated by the program.

### 2.3.2.4 Guide rails

In the dialog screen shown below, we must fill the following data for the calculation of the guide rails:

Guide Rails		Ok
Lift Rated Load Q (Kg)	600.00	Cancel Guide Rails
Car Weight P (Kg)	500.00	
Auxiliary equipment force M (N)		
Impact Factor k3		
Guide Rails material	St37	
Distance between Guide Brackets l (mm)	1100.00	
Car Size on x axis Dx	1400.00	
Car Size on y axis Dy	1100.00	
x pos. of carframe center towards guide rail x axis.(mm)		
y pos. of carframe center towards guide rail y axis(mm)		
x pos. of suspension towards guide rail x axis xs (mm)		
y pos. of suspension towards guide rail y axis ys (mm)		
Des. x pos. of car center towards guide rail x axis xc (mm)		
Des. y pos. of car center towards guide rail y axis yc (mm)		
x pos. of car center towards guide rail x axis xc (mm)	0.00	
y pos. of car center towards guide rail y axis yc (mm)	0.00	
x pos. of door 1 towards guide rail x axis x1 (mm)	700.00	
y pos. of door 1 towards guide rail y axis y1 (mm)		
x pos. of door 2 towards guide rail x axis x2 (mm)		
y pos. of door 2 towards guide rail y axis y2 (mm)		
x pos. of car center of grav. towards guide rail x axis xp (mm)	0.00	
y pos. of car center of grav. towards guide rail y axis yp (mm)	0.00	
Chassis vertical guiding distance h (mm)	2700.00	
Type of Guide Rails	GUIDE RAILS TYPE A/B	
Desirable Guide Rails		
Selected Guide Rails	Nr 5380	
Guide Rails Dimensions	T 50 x 50 x 9	

**Lift rated load Q (kg):** The lift rated load that has been calculated in the “Specific Data” window is shown.

**Car weight P (kg):** The car weight that has been calculated in the “Specific Data” window is shown.

**Auxiliary equipment force M (N):** Enter the force that acts on the guide rails due to the auxiliary equipment, in Newton.

**Impact factor  $k_3$ :** Enter the impact factor  $k_3$  as it is specified from the manufacturer.

**Guide rails material:** Enter the material of the guide rails: St37, St44 or St52.

**Distance between Guide Brackets l (mm):** Enter the distance between guide brackets.

**Car Size on x axis  $D_x$ :** Enter the size of the car on the x axis.

**Car Size on y axis  $D_y$ :** Enter the size of the car on the y axis.

**X position of carframe center towards guide rail x axis (mm):** Enter the position of the center mass of the carframe towards x axis of the guide rail cross-sectional area.

---

**Y position of carframe center towards guide rail y axis (mm):** Enter the position of the center mass of the carframe towards y axis of the guide rail cross-sectional area.

**X position of suspension towards guide rail x axis  $x_s$  (mm):** Enter the position of the suspension (S) towards x axis of the guide rail cross-sectional area.

**Y position of suspension towards guide rail y axis  $y_s$  (mm):** Enter the position of the suspension (S) towards y axis of the guide rail cross-sectional area.

**Desirable x position of car center towards guide rail x axis  $x_c$  (mm):** Enter (if you wish) the distance towards the x axis between the position of the car center and the guide rail x axis.

**Desirable y position of car center towards guide rail y axis  $y_c$  (mm):** Enter (if you wish) the distance towards the y axis between the position of the car center and the guide rail y axis.

**X position of car center towards guide rail x axis  $x_c$  (mm):** The distance towards the x axis between the position of the car center and the guide rail x axis is calculated (if the user hasn't set a desirable one).

**Y position of car center towards guide rail y axis  $y_c$  (mm):** The distance towards the y axis between the position of the car center and the guide rail y axis is calculated (if the user hasn't set a desirable one).

**X position of door 1 towards guide rail x axis  $x_1$  (mm):** Enter (if you wish) the distance towards the x axis between door 1 (opposite to the guide rails) and guide rail x axis.

**Y position of door 1 towards guide rail y axis  $y_1$  (mm):** Enter (if you wish) the distance towards the y axis between door 1 (opposite to the guide rails) and guide rail y axis.

**X position of door 2 towards guide rail x axis  $x_2$  (mm):** Enter (if you wish) the distance towards the x axis between door 2 (next to the guide rails) and guide rail x axis.

**Y position of door 2 towards guide rail y axis  $y_2$  (mm):** Enter (if you wish) the distance towards the y axis between door 2 (next to the guide rails) and guide rail y axis.

**X position of car center of gravity towards guide rail x axis  $x_p$  (mm):** The position of the car center of gravity (P) towards the x axis of the cross section of the guide rail is calculated.

**Y position of car center of gravity towards guide rail y axis  $y_p$  (mm):** The position of the car center of gravity (P) towards the y axis of the cross section of the guide rail is calculated.

**Chassis vertical guiding distance h (mm):** Enter the distance between the guide rails shoes for the chassis drive.

**Type of guide rails:** Choose the desirable type of guide rails from the guide rails library, by pressing F11 or the button inside the field.

**Desirable guide rails:** By pressing F11 or the button inside the field, it is possible to choose a different size of the selected guide rail type from the one that had been calculated by the program.

By pressing the button "Guide Rails" the following screen appears, which shows the calculated values and the maximum acceptable ones.

Guide Rails - Results			Close
Safety gear - Shift towards X			
Bending Stress	sigmam (N/mm <sup>2</sup> )	75.66 <= sigma.al. = 205.	
Bending and Pressing sigma	(N/mm <sup>2</sup> )	113.87 <= sigma.al. = 205	
Buckling and Bending	sigmac (N/mm <sup>2</sup> )	153.34 <= sigma.al. = 205	
Bending Stress of the rail Flange	sigmaF (Nt)	31.37 <= sigma.al. = 205.	
Deflection in the X-axis deltax (mm)		1.38 <= delta.al. = 5.00	
Deflection in the Y-axis deltay (mm)		0.00 <= delta.al. = 5.00	
Safety gear - Shift towards Y			
Bending Stress	sigmam (N/mm <sup>2</sup> )	61.09 <= sigma.al. = 205.	
Bending and Pressing sigma	(N/mm <sup>2</sup> )	99.30 <= sigma.al. = 205.	
Buckling and Bending	sigmac (N/mm <sup>2</sup> )	140.23 <= sigma.al. = 205	
Bending Stress of the rail Flange	sigmaF (Nt)	0.00 <= sigma.al. = 205.0	
Deflection in the X-axis deltax (mm)		0.00 <= delta.al. = 5.00	
Deflection in the Y-axis deltay (mm)		0.85 <= delta.al. = 5.00	
Normal use - Running - Shift towards X			
Bending Stress	sigmam (N/mm <sup>2</sup> )	18.16 <= sigma.al. = 165.	
Bending Stress of the rail Flange	sigmaF (Nt)	7.53 <= sigma.al. = 165.0	
Deflection in the X-axis deltax (mm)		0.33 <= delta.al. = 5.00	
Deflection in the Y-axis deltay (mm)		0.00 <= delta.al. = 5.00	
Normal use - Running - Shift towards Y			
Bending Stress	sigmam (N/mm <sup>2</sup> )	14.66 <= sigma.al. = 165.	
Bending Stress of the rail Flange	sigmaF (Nt)	0.00 <= sigma.al. = 165.0	
Deflection in the X-axis deltax (mm)		0.00 <= delta.al. = 5.00	
Deflection in the Y-axis deltay (mm)		0.20 <= delta.al. = 5.00	
Normal Use - Loading			
Bending Stress	sigmam (N/mm <sup>2</sup> )	24.21 <= sigma.al. = 165.	
Bending Stress of the rail Flange	sigmaF (Nt)	10.04 <= sigma.al. = 165.	
Deflection in the X-axis deltax (mm)		0.44 <= delta.al. = 5.00	
Deflection in the Y-axis deltay (mm)		0.00 <= delta.al. = 5.00	

### 2.3.2.5 Buffer

The program calculates automatically the following fields (in red color):

**Rated load Q (kg)**

**Sum of carframe and car force P (kg)**

**Downward car speed Vc (m/s)**

For the calculation of the buffers, the following data must be entered:

**Number of car buffers:** The number of buffers shall be filled.

**Desirable type of buffers:** By pressing F11 or the button inside the field, you can choose (if you wish) from a number of buffer types, a different type from the one selected by the program.

Buffer		Ok	Cancel
Rated Load Q (Kg)	600		
Sum of Carframe and Car Force P (Kg)	500		
Downward Car Speed Vc (m/s)	0.63		
Number of Car Buffers	1		
Desirable Type of Buffers			
Selected Type of Buffers	Energy accumulation type with linear characteristi		
Minimum Required Travel Height S (mm)	65.00		
Minimum Static Load per Car Buffer (Kg)	2791		
Maximum Static Load per Car Buffer (Kg)	4466		

---

The choices appearing in the “Desirable buffers type” are the following:

- Energy accumulator type with linear characteristics
- Energy accumulator type with non linear characteristics
- Energy accumulator type with buffer return movement
- Energy dissipation type

The following results are displayed:

**Selected type of buffers**

**Minimum required travel height S (mm)**

**Minimum static load car buffer (kg)**

**Maximum static load car buffer (kg)**


### 2.3.3 View

This option includes the sub-option “Toolbars”, according to the usual windows standards.

### 2.3.4 Windows

#### 2.3.4.1 Cover Page (of the project issue)


The “**Cover Page**” window is the first page of the project that is printed and the program gives the possibility to the user to select between different types of cover pages, or even to create his own cover page, as it is desired. By choosing “Cover page”, the option “cover page” appears in the menu including the sub-option “Prototype Selection”. By choosing a specific cover page prototype, a window with the respective text appears.

 **Note:** Cover page prototype files are located in the FINE11\_LIFT\CALC\Ane\ directory with names ANELCV01.RTF, ANELCV02.RTF, etc, and the descriptions of the prototypes can be found in the file ANELCP.LST, which is located in the same directory.

#### 2.3.4.2 Assumptions

The general assumptions text of the project issue is shown (summary of the norm), which can be included in the project’s printout provided that it has been chosen in the “Printing Contents”. By choosing “Assumptions”, the option “Assumptions” appears in the menu including the sub-option “Prototype Selection”. By choosing a specific assumptions prototype, a window with the respective text appears.

**Caution!** Depending on the lift type (hydraulic or electric), the program automatically displays the respective assumptions from the assumptions prototypes.

 **Note:** It is reminded that assumptions prototype files are located in the FINE11\_LIFT\CALC\Ane\ directory with names ANELPR01.RTF, ANELPR02.RTF, etc, and the descriptions of the prototypes can be found in the file ANELPR.LST, which is located in the same directory.



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#### **2.3.4.3 Project Printout**

This option opens a window with the Project text, which can be edited by the user according to what was mentioned in section 1.3.4. In particular, pressing the “Edit” icon replaces the main menu with the text editor menu giving you the capability to edit and change it until you close it (selecting “Exit”), so you see the text again in yellow background.

#### **2.3.4.4 Bill of Quantities**

This window shows a detailed list of the materials used in the project, the cost of each one and the total cost.

#### **2.3.4.5 Drawing**

This option opens the window “Drawing” in which the user can import one of the pre-drawn drawings included in the program. This can be done by choosing “Drawing selection” which is in the group “Drawing” appearing right next to the “Windows” option, when you open the window “Drawings”.

You can use the options of the group “View” to preview the drawings in your screen, as well as the option scale to set their printing scale.

The user can also use helpful drawing tools (real-time pan, real-time zoom, zoom window, zoom extents).

Furthermore, the user can export the drawing to dwg or dxf file and activate 4MCAD or AutoCAD.

#### **2.3.4.6 Technical Description**

The “**Technical Description**” window supports composition of the project’s technical description, allowing selection of different technical description prototypes with all word processing features available, as we will see below, and free configuration of new prototypes according to the user’s desire. By selecting “**Technical Description**” the corresponding window appears, updated with the project’s results. When the Technical Description window is activated, an additional option in the main menu (just above the “Windows” option) is appeared with the name “Technical Description”.

Choosing “Prototype Selection” from this menu the prototype management window will appear on our screen together with the list of the available prototypes for the application we work with.

Selecting the corresponding prototype (with the help of the mouse and using the “Load” key), the corresponding text appears in the Technical description window (in yellow background and with updated results of the project). Any desired modification in the technical description of the project, either by changing the position of a word-parameter or processing the text the way we want to, can be done by pressing the “Edit Prototype” icon.

---

**Caution:** Depending on the lift's type (hydraulic simple or MRL, electric simple or MRL) the program automatically displays the respective description from the technical description prototypes.



**Note:** It is reminded that technical description prototype files are located in the FINE11\_LIFT\CALC\Ane\ directory with names ANELTP01.RTF for the first prototype in the list, ANELTP02.RTF for the second, etc, and the descriptions of the prototypes can be found in the file ANELTP.LST which is located in the same directory.

## 2.3.5 Libraries

Application's libraries contain:

- **Guide Rails:** Guide rails categories are included and each category contains different types. Each type contains the material (e.g. St33), the size (e.g. T50x50x50), the cross-sectional area, the shoe thickness, the moment of inertia, the moment of resistance, its flange width, its flange shoe thickness, its bolt diameter, its cost and type.
- **Wire ropes:** The user can define wire ropes types with their standardized nominal diameter, weight and their respective breaking loads.
- **Pulleys:** The standardised diameters with their weight and cost are shown.
- **Electric lift motors:** Motors library contains several types with their rated power (HP) and their respective cost.
- **Pistons:** In the pistons library categories can be defined and for each category a number of different types. Each type contains the following data: Material, piston outer diameter, piston inner diameter, wall thickness of piston, piston weight, cylinder outer diameter, cylinder inner diameter, wall thickness of cylinder, maximum pressure and cost.
- **Pumps:** The pumps of the library are defined by their type, flow rate, coefficient a and b, cost and code.
- **Supply Pipes:** Each supply pipes type contains its name and material as well as a number of external, inner and nominal diameters and their respective thickness and static pressure as well as test pressure and cost.
- **Hydraulic lift motors:** Motors library contains several types with their rated power (HP) and their respective cost.
- **Pulley axes:** Each pulley axis type has its material, diameter, moment of resistance, stress lever arm and cost.
- **Belts:** Each belt type has its description, nominal diameter, weight, breaking limit, cost and wire diameter.
- **Belt pulleys:** Each belt pulley has its description, diameter, weight and cost.
- **MRL motors:** MRL motors library contains several types with their rated power (HP) and their respective cost.

Libraries are open to any update from the user.



**Notes:** Library files used by the Lifts program are located in the FINE11\_LIFT\LIBS\DATAF\ directory with the following names:

Guide rails	DBK1.MDB
Wire ropes	DBK2.MDB
Pulleys	DBK3.MDB
Electric lift motors	DBK4.MDB
Pistons	DBK5.MDB
Pumps	DBK6.MDB
Supply Pipes	DBK7.MDB
Hydraulic lift motors	DBK8.MDB
Pulley axis	DBK9.MDB
Belts	DBK11.MDB
Belt pulleys	DBK12.MDB
MRL motors	DBK13.MDB

### 2.3.6 Help

“Help” includes a number of options that aim to support the user in learning each application following various ways. The most important of them is the “**Contents and Index**” option according to the common windows standards.



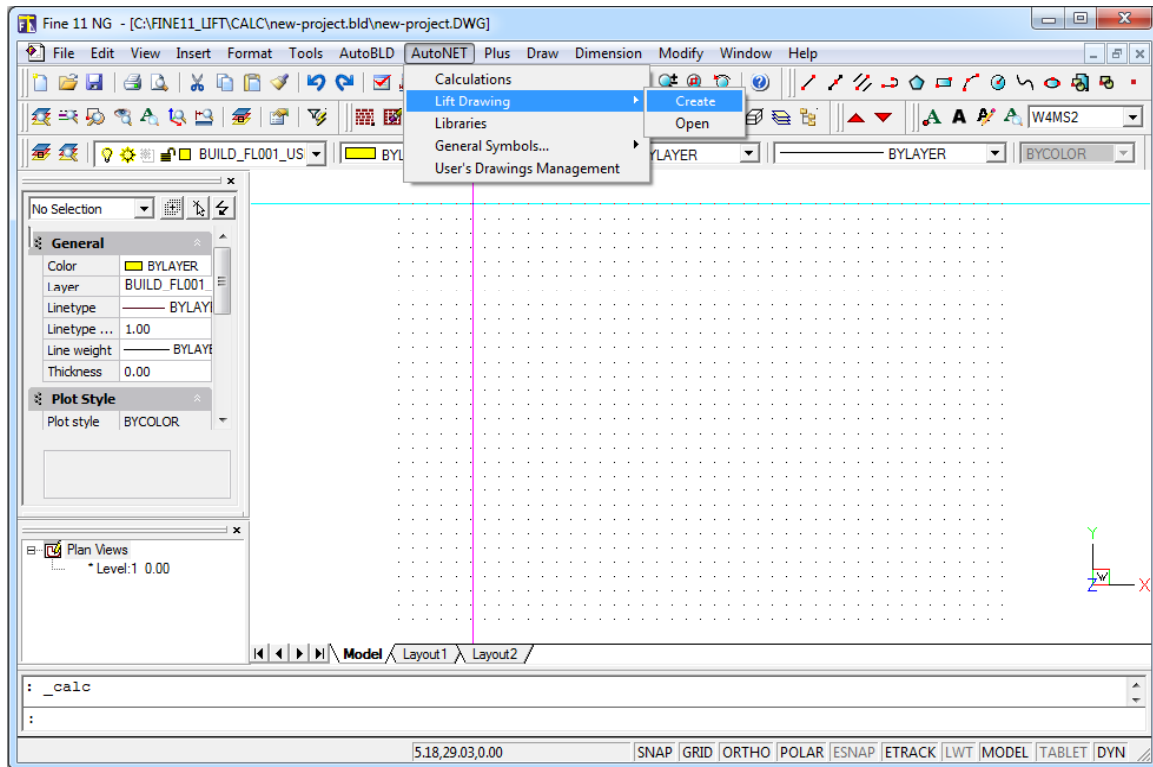
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## 3. CAD Component

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### 3.1 General Environment

As mentioned earlier, the general CAD Environment is characterized by an Autocad like user interface, as shown below:

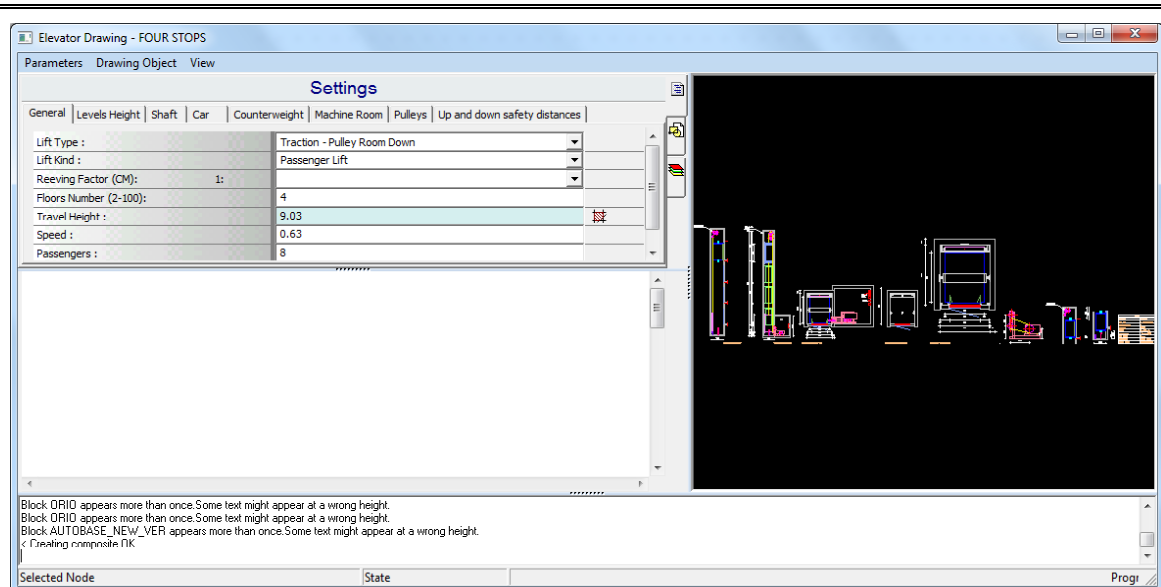


The “Lift Drawing” command, next to the “Calculations” command, located within the AutoNET group of commands, generates the detailed drawings that should be attached to the calculations output, shown in the previous chapter. In particular, drawings are being automatically generated through the component and the procedure described in the next paragraph 3.2.

### 3.2 Generation of Lift Drawings

#### 3.2.1 Introduction

After selecting the instruction “Lift Drawing” -> “Create”, the following window appears on screen. The drawing processor generates the drawings which are necessary for the completion of the study in relation to the calculation results.



More specifically, this window is composed of five parts:

- The part including the calculation parameters
- The part including the drawing parameters
- The part including the layer parameters
- The part corresponding to the viewer of the drawings
- The part where messages plus information related to the creation of the drawings are shown.


Within the main menu, we can see the options “Parameters”, “Drawing object” and “View”.

By using the “Parameters”, we can initialise anytime the values of the drawing, based either on the values that have been calculated through the case study, or on the values of the latest saving. The second case prerequisites the fact that the drawing has been already created once.

The changes made on the drawing, appear in a real time basis on the viewer, given that the “auto-refresh” has been selected from the “drawing object” menu. Alternatively, the review can be also done by pressing “F5” key.

From “View” option we can change the appearance of the window (i.e. activation or inactivation of the message window).

### 3.2.2 Calculation Parameters

Most of the fields are filled through the results deriving from the calculations part. However, the user can process the drawing according to his preferences. For this reason he can modify the values of the fields, either by inserting other values, or by getting values through the technical libraries of the program. In this case he has to use the icon  which is next to each value field (corresponding to library items).

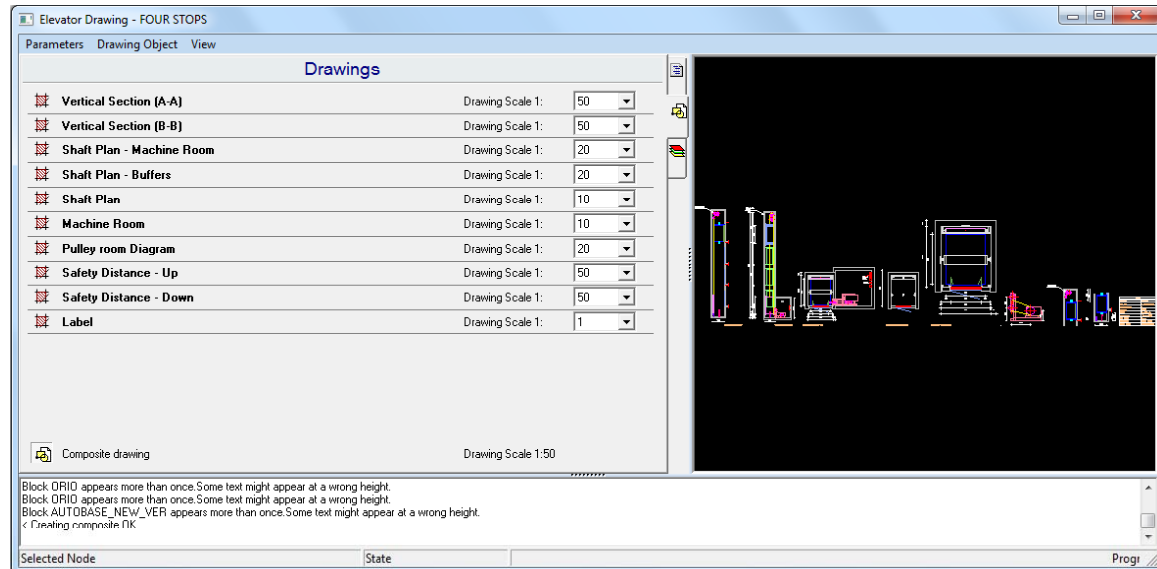
In addition, the user can use the icons  which refer to an auxiliary window, containing any alternative choice.


Value fields are colored with a color depending on their attributes. In particular:

Fields with a white background contain just simple values.

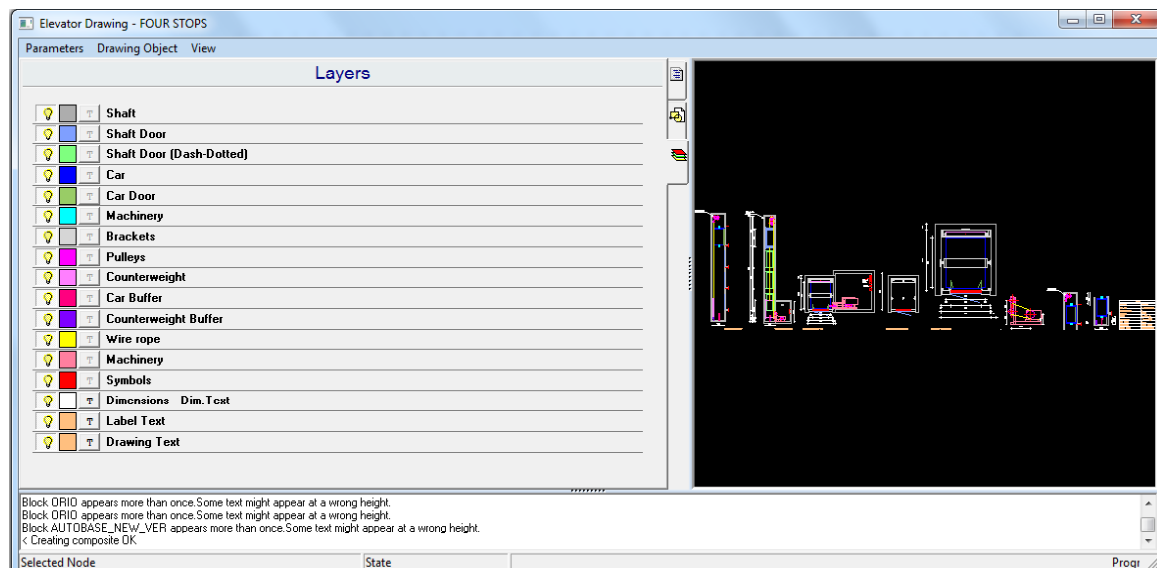
Fields with a cyan background contain values which result either by library tables, or depend on other values and are deriving from calculations. In the specific case of the “reeving factor (Cm)”, which has a grey background, the value is occurring from the selection of the type of elevator and should not be changed by the user.

### 3.2.3 Drawing Parameters



In this section, we define the drawing scales for each individual drawing. Besides, by pressing the icon  we can see the related drawing (i.e. view plan of well). By pressing the icon of the composite drawing, we can see the whole drawing composed of the individual drawings, each one having been drawn with the appropriate drawing scale.

### 3.2.4 Layers Parameters



Here we define the colors for the different layers, as well as the heights of the texts (in drawing mm) which are inserted within the drawings.

In addition, we define the layers that will be visible or not.

---

### 3.2.5 Preview

This window permits the drawing preview through the following facilities:

- Real time pan
- Real time zoom
- Zoom window
- Zoom extents
- Regen

The functionality of those commands, can be easily realized by the user.

### 3.2.6 Messages

During the creation of the drawings, if there are any mistakes, then related messages appear in bold red characters. Additional information shows the progress of the drawing creation during the generation.

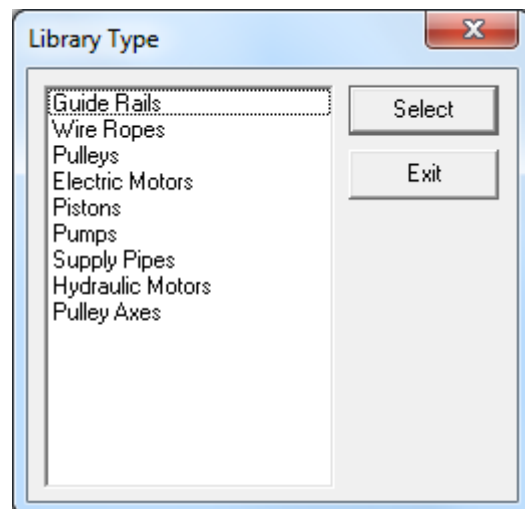
Finally, after closing the window “elevator drawing”, a file is created named as the project file with the suffix “LV” and the extension dwg (i.e. nprojectLV.dwg), where we can carry out any modification we might need (i.e. correction of the location of the machine-room, addition of a door to this room and so on).

In case we want to use the “ready to use” drawings from FINE library elevator drawings, we should select the option “Elevators” from the “General Symbols” first. Then, we just need to select the drawings we need through the slides menu. In order to print the elevator drawings with the desired scale, we need to proceed to the following steps:

- Decide the plotting scale, i.e. 1:50 (in this case we will define 1000 mm = 50 drawing units)
- The parts of the drawing we want to be in a different scale, i.e. 1:20, we scale them with the ratio  $[\text{general printing scale}]/[\text{printing scale of the drawing}]$ , i.e.  $50/20=2.5$ , which means that we will scale the drawing 2.5 times to be in 1:20 scale.
- From AutoBLD» -> «Drawing - Symbols» -> «General» we select a label at the appropriate scale.

## 3.3 Libraries

Libraries refer to the following equipment (as shown in the respective menu) and are the same with the ones included within the Calculation Environment, where they can be updated.



## 3.4 Symbols & Drawings

### 3.4.1 General symbols

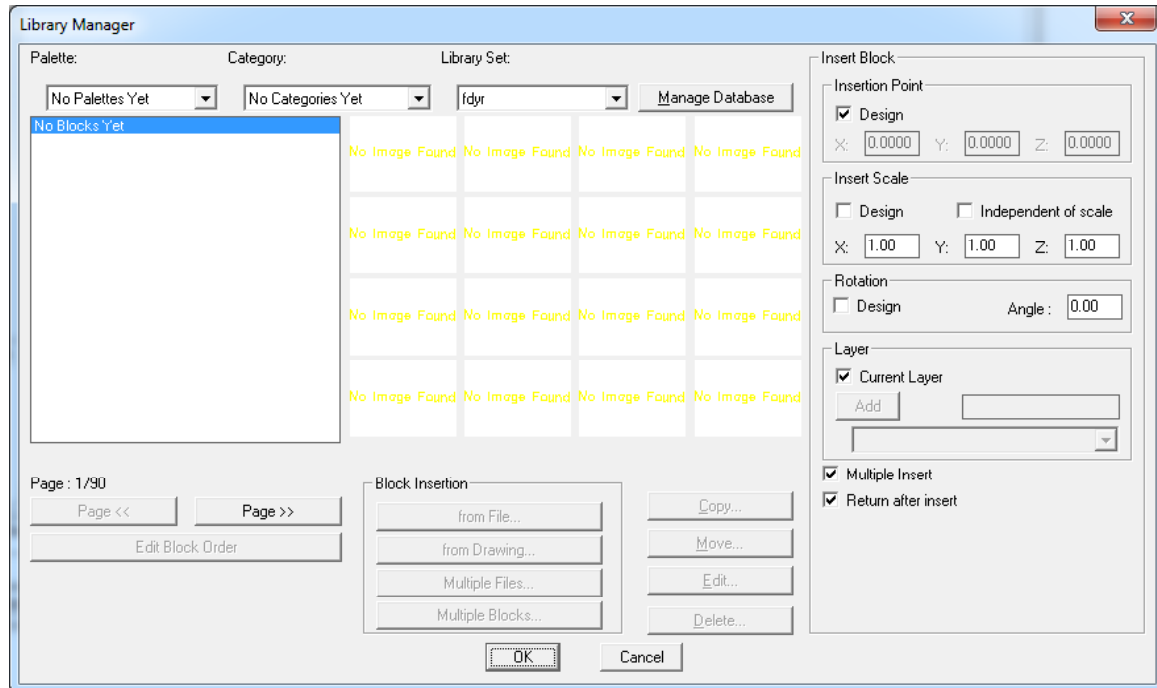
"General Symbols" include various general symbols, configurations and other drawings that can be used in elevator case studies.



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### 3.4.2 User's Drawings Management

The "User's Drawings Management" option leads to a submenu that includes all the drawings that the user creates on his own.



You can easily insert one or more new blocks by selecting:

**From file**

**From drawing**

**Multiple files**

**Multiple Blocks**

**Insertion point:** Determine the point according to which the drawing or block will be inserted.

**Insert scale:** Determine the scale of the drawing or block that will be inserted.

**Rotation:** If you want to rotate the block or the drawing, check the box and give the rotation angle.

**Layer:** Determine the layer of the drawing or block that will be inserted.

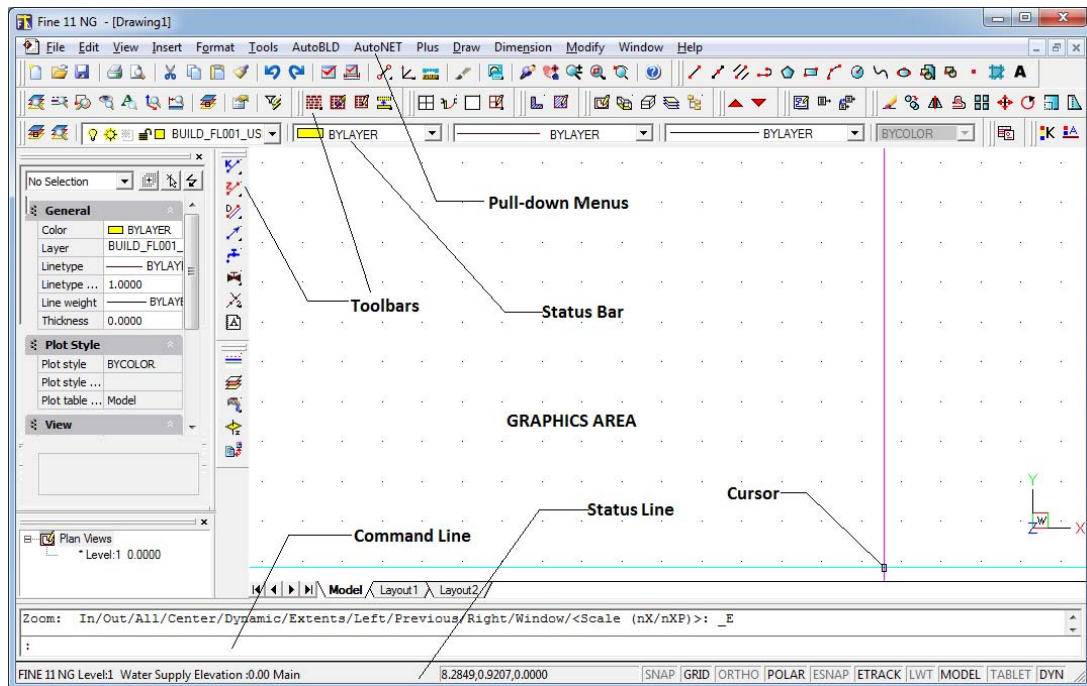
Apart from that, you can check the **"Multiple insert"** option so as to be able to insert simultaneously more than one blocks or drawings.

You can copy, move, edit or delete an inserted block or a drawing by selecting it from above and click on one of the buttons at the bottom of the page.

On the upper part of the window, you can edit the palettes, categories and libraries you have created by pressing **"Manage database"**.

## 3.5 Drawing Principles & Basic Commands

A great advantage of the package is that the structure and the features of the drawing environment follow the standards of the CAD industry adopted by AutoCAD, 4MCAD etc. In particular, the available working space is as follows:



As shown in the above figure, the screen is divided into the following "areas":

- **Command line:** The command line is the area where commands are entered and the command messages appear.
- **Graphics area:** The largest area of the screen, where drawings are created and edited.
- **Cursor:** The cursor is used for drawing, selecting objects and running commands from the menus or the dialog boxes. Depending on the current command or action, the cursor may appear as a graphics cursor (crosshairs), a selection box, a graphics cursor with a selection box etc.
- **Pull-down menus:** These menus appear by selecting them with the .
- **Status Line:** It is the line on the bottom of the screen where the current level , the drawing status and the current cursor coordinates are displayed.

Please note that each mouse button performs a specific function. The functions of the mouse buttons are the following:

**Left button:** Selection of a command, point or object.

**Right button:** Enter

**Note:** In case your mouse has only two buttons (or it has three buttons, but the mouse driver has not been properly installed for the middle button to function), the first two functions are executed as described while the third one can be substituted by the combination of the "Shift" key and the right mouse button (right click while <Shift> is pressed down).

---

### 3.5.1 Drawing aids

This section describes the basic drawing aids available to the user. These are the commands **Esnap** (object snap), **Ortho** (vertical/horizontal drawing), **Grid** and **Snap** (movement increment). More specifically:

**ESNAP:** The "Esnap" command forces the cursor to select a snap point of an object, which is within the Pick box outline. The snap points are certain characteristic geometric points of one or more objects, like the midpoint or one of the endpoints of a segment or arc, the center point of a circle or arc etc. If you have specified a snap point and move the cursor close to it, the program will identify it with a frame. The "Esnap" command can be activated either by holding down the "SHIFT" key and right clicking the mouse or by clicking the middle mouse button (if there is one available and active) or through the additional toolbar (version for Windows). For example, if we select "Endpoint" from the menu, then this action *Selects one of the two endpoints of an object (the one closer to the selection point)*.

**ORTHO:** The "Ortho" feature restricts the cursor to horizontal or vertical movement. The status bar shows whether the "Ortho" command is activated by displaying "ORTHO" in black characters (in AutoCAD, the indication "O" also appears on the top left side of the screen). The command is activated or deactivated by clicking the corresponding button-icon or by pressing **F8**.

**GRID:** The screen grid is a pattern of vertical and horizontal dots, which are placed at the axes intersection points of an imaginary grid. The grid distance may be different on the **X** and on the **Y** axis. The grid can be activated or deactivated by clicking the corresponding button-icon or by pressing **F7** (If the grid is active, it appears on the Status Bar). Grid is a visual drawing aid that appears only on the screen and is not printed. If you want the grid to be printed, you should draw it yourself.

**SNAP:** The graphics cursor position coordinates appear in the middle of the upper part of the graphics area. If "Snap" is selected, the graphics cursor movement may not be continuous but follow a specific increment (minimum movement distance). When "Snap" is on, the cursor seems to adhere, or "snap", to an invisible grid. "Snap" can be turned on and off either by clicking the corresponding button/icon or by pressing **F9**. (If it is activated, it appears on the Status Bar). If the command is active, the "**S**" indication also appears in the top left corner of the screen. The default Snap setting is **0.05 m** for both axes (X and Y).

### 3.5.2 Drawing Coordinates

When you need to determine a point, you can either use the mouse (by seeing the coordinates in the status bar or using the snap utilities), or enter the coordinates directly in the command line. Moreover, you can use either Cartesian or polar coordinates, either absolute or relative values, in each method (relative coordinates are usually more convenient).

**Relative coordinates:** Enter the @ symbol (which indicates relative coordinates) and then the x,y,z coordinates (Cartesian system) or the  $r<\theta<\phi$  coordinates (polar system) in the command line. The system used (Cartesian or polar) is defined by the "," or "<" symbol. If you do not insert a value for z or  $\phi$ , it will be automatically taken as zero. For example, if you are prompted to locate the second (right) endpoint of a 2 m horizontal line, you should enter:

@2,0 if you use the Cartesian coordinates (which means that the distance of the second point from the first is 2 m on the x axis and 0 m on the y axis), or

@2<0 if you use the polar coordinates [which means that the second point is at a distance of 2m ( $r=2$ ) and an angle of 0 degrees ( $\theta=0$ ) from the first].

---

**Absolute coordinates:** These are specified like the relative coordinates, but without using the @ symbol. The absolute coordinates are specified in relation with the 0,0 point of the drawing.

The measurement system can be activated, deactivated or changed with the F6 key.

### 3.5.3 Drawing Basic Entities

**Line:** "Line" option is used for drawing segments. When you select "Line" from the menu or type "Line" in the command line, you will be prompted to specify a start point (by left clicking or by entering the point coordinates – relative or absolute – in the command line) and an endpoint (determined in the same way).

**Arc:** The "Arc" command is used for drawing arcs. An arc can be drawn in different ways: The default method is to specify three points of the arc ("3-Points"). Alternatively, you can specify the start point and endpoint of the arc as well as the center of the circle where it belongs (St, C, End). The user will not find it difficult to understand and become familiar with the various methods of drawing an arc.

**Polyline:** This command allows you to draw polylines, which are connected sequences of line or arc segments created as single objects. The command is executed by either using the menu or typing "pline" in the command line. You will be prompted to specify a start point and an endpoint (by right clicking the mouse or by entering the point coordinates – relative or absolute – in the command line). Then, the command options will appear (Arc, Close, Length etc). Select **A** to switch to Arc mode, **L** to return to Line mode and **C** to close the polyline.

### 3.5.4 Useful Commands

This section includes brief descriptions of the basic program commands, which will be very useful to the user. These are the commands "Zoom", "Pan", "Select", "Move", "Copy" and "Erase". In particular:

**Zoom:** "Zoom" increases or decreases the apparent size of the image displayed, allowing the user to have a "closer" or "further" view of the drawing. There are different zooming methods, the most functional of which is the real-time zooming ("lens / ±" button). You can use the mouse to zoom in real time – that is to zoom in and out by moving the cursor. Within the zoom command, click and hold down the left mouse button and move the cursor up and to the right to zoom in or down and to the left to zoom out. There are a number of helpful zoom options which become available by selecting "Zoom" in the "View" menu or by typing "Zoom" (or just "Z") in the command line. These options are:

All/Center/Dynamic/Extents/Left/Previous/Vmax/window/<Scale(X/XP)>

Each of these options zooms in a different way. The most common is the "Window" sub-option, which magnifies a part the drawing, included in a (user defined) imaginary rectangle.

**Pan:** "Pan" ("hand" icon) moves the position of the visible part of the drawing, so that you can view a new (previously not visible) part. The visible part of the screen moves towards the desired area and to the desired extent.

**Select:** This command selects one or more objects (or the whole drawing), in order to execute a specific task (erase, copy etc.). Select is also used by other CAD commands (for example, if you use the "Erase" command, "Select" will be automatically activated in order to select the area that will be erased).

**Move:** This command allows moving the objects from one location to another. When the "Move" command is activated, the "Select" command is also activated so that the object(s) the user wants to move (in the way described in the previous paragraph) can be selected.

---

After you have selected the desired object(s), you are prompted to specify the base point (using the snap options), which is a fixed point of the drawing. When you are prompted to specify the position where the base point will be moved, use either the mouse or the snap options. After you have completed this procedure, the selected object(s) will move to the new position. Please note that the base and the new location points can be also specified with the use of coordinates (absolute or relative, see related paragraph).

**Copy:** The "Copy" option allows the copying of objects from one location to another. The "Copy" procedure is similar to the "Move" procedure and the only difference is that the copied object remains at its original location in the drawing.

**Erase:** Choose this option to delete objects. The procedure is simple: Select the objects you wish to erase (as described above), type "E" in the command line and press <Enter>. Alternatively, you may first type "E" in the command line, then select the object(s) by left clicking and finally right click to erase the object(s).

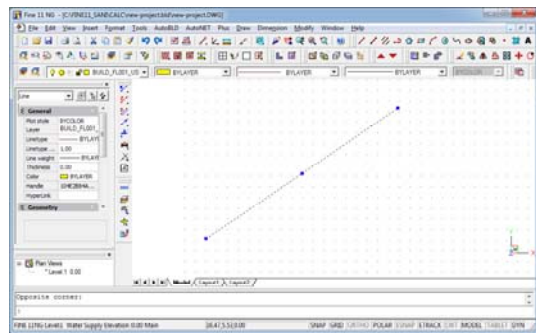
**DDInsert (Insert Drawing):** This command allows the user to insert another drawing (DWG file) or block in the drawing. When this command is selected, a window appears in which you should select block or file and then select the corresponding block or file from disk. Then you are prompted to specify the insertion point, the scale factor etc, so that the selected drawing is properly inserted.

**Wblock:** The "Wblock" command allows us to save part of a drawing or the entire drawing in a file, as a block. When this command is selected, you are prompted to enter the file name and then you should select the drawing or the part of the drawing you wish to save. The use of this command is similar to the "Screen Drawing" command, which will be described in a following section. In order to insert a block in a drawing, you should use the "ddinsert" command described above.

**Explode:** The "Explode" command converts a block in a number of lines so that you can edit it in that form. If it is selected, the program will prompt you to select the block ("Select object") you wish to explode.

### 3.5.5 Grips

Grips are some characteristic points of an object which appear after it is selected (by placing the graphics cursor with the selection box on the object and left clicking). Then object is displayed with grips (small blue squares), which mark control locations and are powerful editing tools. When you click a grip, it turns red and the following prompt appears in the command line: **\*\*STRETCH\*\*** <stretch to point> /Base point /copy/ undo/ exit. If you press <Enter> (or right click), the first characters of the corresponding word are entered, e.g. "sc and enter" for the "Scale" command).



When a command is executed, grips disappear and the objects are deselected. If the command is an editing command (correction or copy), which can be preselected, the objects take part in the execution of the command automatically. In this case, the command overrides the "Select objects" prompt and proceeds. To deselect grips and objects you should press <Esc> twice. Once to deselect the objects and twice to deactivate the grips.

---

In each object the positions of the grips are different. Namely, for a point the grip is the point itself, for a segment the grips are the midpoint and the two endpoints, for an arc the midpoint and the two endpoints, for a circle the center and the quadrants, for a polyline the endpoints of the line and arc segments and the midpoints points of the arc segments, for a spline the spline points, for a block the insertion point, for text the insertion point etc.

### **3.5.6 Print**


This section may be read after the user has created a drawing and wants to print it. Any drawing can be printed using a printer or plotter or to a file. Printing is performed using "PLOT" command, selected either from the "FILE" menu or typing it in the command line, provided there is a drawing already loaded.

#### ***3.5.6.1 Previewing a drawing before printing***

Viewing a drawing before printing gives you a preview of what your drawing will look like when it is printed. This helps you see if there are any changes you want to make before actually printing the drawing.

If you are using print style tables, the preview shows how your drawing will print with the assigned print styles. For example, the preview may display different colors or lineweights than those used in the drawing because of assigned print styles.


##### **To preview a drawing before printing**

1. If necessary, click the desired Layout tab or the Model tab.
2. Do one of the following:
  - Choose File > Plot Preview.
  - On the Standard toolbar, click the Print Preview tool ().
  - Type ppreview and then press Enter.
3. After checking the preview image, do one of the following:
  - To print the drawing, click Plot to display the Plot dialog box.
  - To return to the drawing, click Close.

#### ***3.5.6.2 Printing a drawing***

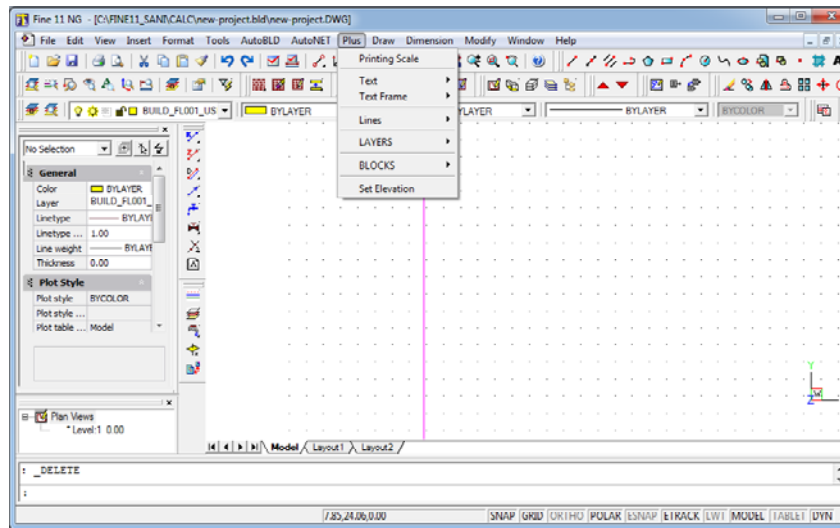
The Print dialog box is organized by tabs into the areas: scaling and viewing, and advanced printing options. For help defining print settings before you print, see Customizing print options.

##### **To print a drawing**

1. If necessary, click the desired Layout tab or the Model tab.
2. Do one of the following:
  - Choose File > Plot.
  - On the Standard toolbar, click the Print tool (). If you click the Print tool, the Print dialog box does not display. Your drawing will be sent directly to the selected printer.
  - Type print and then press Enter.
3. From the Print dialog box, make any adjustments to the settings.
4. Click Print.

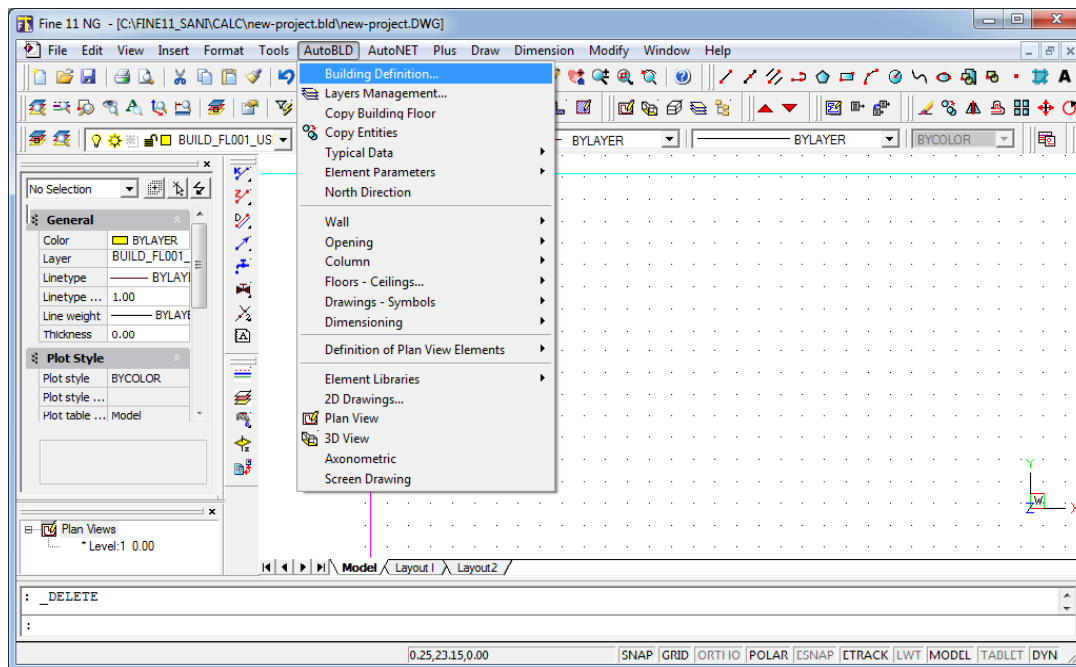
### 3.5.7 Plus Drawing Tools

Those tools belong to the large group of options under the general menu PLUS. These are a series of additional drawing tools, which have been embodied in the package in order to help the user during drawing, and are described within the Full User's Guide.



### 3.5.8 Architectural Drawing Tools

Those tools belong to the large group of options under the general menu AutoBLD. In fact, AutoBLD option group, serves only for designing the Architectural plan view, in case the user needs to present drawing of its elevator, within the Architectural drawings. In general this is not necessary, however FineLIFT includes this option and the details are mentioned within the complete User's Guide.



In short, as we can see from the program menu, the AutoBLD commands and instructions deal with the facilities required to create an Architectural drawing, and are divided into sub-groups: The first sub-group includes commands for the definition of the project parameters, the second sub-group includes drawing functions, the next sub-group includes management options for the AutoBLD libraries (Architectural objects and symbols) and the last sub-group includes commands for the building viewing tools.