How to estimate the cost of installing an Electrical Distribution Center (EDC)

Candidate Number 0112233

June 2012

Table of Contents

1. Introduction

The purpose of the following technical paper is to provide the reader some general information on how to properly estimate the installation of an Electrical Distribution Center or EDC as it is often referred in the construction industry.

Main CSI Division

Division 16000

Specific Sub-Division: Code and Name

Division 16050 Basic Electrical Materials and Methods
Division 16100 Wiring Methods
Division 16405 Electrical Distribution Center

The Electrical Distribution Center or EDC was introduced to the construction industry as a "time saver", and time is money. These EDC "houses" are constructed as a single unit containing switchboards, panel boards, dry type, step down transformers, grounding conductors from each transformer to ground chase through the floor of the EDC, plywood mounting boards for the low voltage systems, general duty service receptacles, light fixtures, and switches. Nearly all switchgear manufacturers have EDC units available, ranging from large 4,000A units to smaller 400A units. Each unit is UL listed and is preassembled and each EDC is specifically designed at an offsite manufacturing facility, according to the specific needs and requests of the owner. The larger EDC houses are also constructed with detachable lift connections for easier installations. The other key aspect of the design of the EDC house is that each one is manufactured and delivered as weatherproof units. It is important to maintain these units in their weatherproof condition until the building is fully enclosed. This allows the switchgear to be heated up early and used as the main temporary power source.

In today's commercial construction market, time is truly of the essence. Owners are expecting their projects completed faster, and at the same time expecting their projects to be built for less money. Historically, the typical large box retail stores were constructed with the schedule in mind and the cost for construction was less important. That is not to say that money was no object, not at all, but the owner wanted to sell his merchandise as quickly as possible. Therefore, many overtime hours had to be figured in order meet critical grand opening dates, which drives up the cost of a project. Today, however, these same large box retail owners are getting both, quick construction schedules as well as less expensive projects. In this article, we will discuss and compare how the installation of EDC units is one of the ways that owners have been able to achieve this goal.

2. Types and Methods of Measurements

There are many factors that comprise the complete installation of any EDC such as the underground rough-in of conduits to other EDC units or panel boards, as well as the overhead installation of roof top units. However, this paper will only focus on the actual installation of an EDC unit. Any piece of switchgear cannot actually be considered "installed" until it has been fed from its power source.

For our purposes in this article, we will focus on the installation of a 3,000A unit that will be installed inside a large box retail store. Here are a few things that an estimator will need to know in order to properly account for the material and labor to install this unit:

- It is imperative to obtain the manufacturer's shop drawings, rigging diagrams, and equipment specifications of the unit.
- It is also important to know the weight of the unit (we will discuss reasons later on).
- If at all possible, the estimator should tour an existing store which has an EDC in place or better yet, request permission to view the installation process during an on-going construction process.

After the estimator has reviewed the specifications regarding the EDC house and its physical layout, it is now time to review the EDC house that is drawn within the electrical sheets of the project. When we turn to the one-line drawing schematic of this EDC house, we will notice several things of importance (refer to sheet 9 for schematic drawing).

One of the first things the estimator will notice is the bolder dashed line that designates all the panel boards and other equipment located within the EDC House (EDC1 per the sketch). These items have all been pre- installed from the factory. The second item to notice is the smaller dashed lines running from the MSB to other panel boards or equipment within the unit. These lines represent the conduit and wiring that has been installed by the EDC manufacturer of the specific unit at the factory. However, it is important to know that per the electrical specifications, the installer of the EDC unit is responsible to check every termination that was made at the factory and re-torque, if required, per the manufacturer's instructions.

The next phase of the estimate we consider is the rough-in portion of the EDC house. There are typically many underground feeders leaving a large EDC unit, such as we are estimating today. Any "loose" switchboard, panel board, or other smaller EDC unit, which is not installed within the main EDC unit, will either be fed underground, such as the secondary service entrance, or overhead to power the AHU. The one-line diagram shows an example of these two feeders.

For the Main Switchboard within the EDC1 unit, we are installing a 3000 amp, 480/277V, 3 phase, 4 wire system. Therefore we are to include (8) sets of 4" PVC schedule 40 conduits with each conduit containing (4) #750kcmil aluminum wires. The estimator will notice that on this one-line diagram, an option to run copper or aluminum is offered. To be most competitive, aluminum wiring should be chosen, due to the fact that aluminum wiring is less expensive to purchase than copper wiring. Typically, this secondary service will be one of the largest single assemblies in your estimate; so much consideration should be given in order to estimate it accurately and competitively.

For this paper however, we will only focus on the setting in place of the EDC unit and the hours and materials associated with it.

Once the estimator completes the underground rough-in portion of the estimate, that is any feeder entering or leaving underground from the EDC unit, including the grounding to footers and water pipe, as well as any stub-outs for the telephone service, it is time to review the installation of the 3,000A EDC unit.

It must be understood that certain scopes of work must be completed in sequence to allow for a smooth project. All parties have their role to play. The building pad has to be prepared, then the conduits are to be roughed in place, after this the concrete can be poured around the conduits. Once the block walls have been installed, we are ready to place the EDC unit.

On the day of the arrival of the EDC unit, several hours will be required to ensure that there is a smooth transition and placement of the EDC unit onto the pad safely from the delivery truck. A 10 ton crane is recommended to unload an EDC unit of this size. It is recommended that the estimator sub out this portion of the project. A crane company is typically more experienced in setting large equipment, and therefore able to perform the task of unloading the unit with more efficiency than that of the Electrical Contractor. The estimator should include in his estimate a company that is familiar with unloading large pieces of equipment and is licensed and insured. A crew of 3 – 4 experienced technicians is required to assist the crane company with the setting of the unit in its correct location. This process will range in time from 1-4 hours depending on the size of the EDC unit. It is recommended for a 3,000A unit, 4 hours for 4 men be included.

During the shipping process of the EDC unit from the factory to the jobsite, it is very likely that some of the factory terminations have worked loose, and therefore the verification process of each termination falls on the responsibility of the electrical contractor. Documentation must be done in the field verifying this work was inspected and completed.

3. Specific Factors in Take-off and Pricing

Consideration for the installation of the EDC house needs to occur many weeks prior to the completion of the underground rough-in. It is typically the responsibility of the electrical contractor to ensure proper delivery of the unit. The estimator will need to include the cost for a crane to set the EDC house in place. It is recommended that the estimator call prior to bid day for pricing from at least two different sources, and should only deal with those firms who are familiar with setting larger EDC houses. The estimator should ensure that the crane company is including a crane large enough to pick up the EDC house from the delivery truck and set it directly on the pad. The estimator should also verify the pricing includes spreader bars to eliminate the possibility of the slings, which are used to hoist the unit, from pinching the sides and damaging the unit.

Fluctuation of material costs is always something an estimator should consider. Steel, copper and even aluminum products tend to fluctuate on a weekly basis. It is recommended that the estimator send out his bill of material for these products to an electrical supply house for accurate and up to date pricing.

Historically, each EDC is furnished by the owner. Even though the unit is provided by others, this is something that the estimator should consider. When the estimator has completed the take-off and has arrived at job cost, the percentage of mark-ups should be adjusted slightly higher due to the fact that the electrical contractor does not get to include mark up on the quoted materials.

4. Overview of Labor, Material, Equipment, Indirect Costs and Approach to Mark-Ups

The total price to install an Electrical Distribution Center can broken down into the following categories: labor, material, equipment, indirect costs, and mark-ups (overhead and profit). An electrical estimator should take time to review all plan documents and specifications to accurately provide a proposal to the GC. We will take a detailed look at each of these categories.

Labor

Labor is obviously a critical part in any "successful" project. A smart crew leader, along with competent skilled electricians is the key to success. The crew is composed of many men, all with varying degrees of skill, experience, and hourly compensation. The estimator is required to know (or at least closely anticipate) the "crew rate" for each project in order to provide the electrical contractor with the best chance of success. Below is an example of how a crew rate was derived for the installation of a 3,000A EDC unit.

Labor Type	Crew	Hours	Rate $	Subtotal	Brdn	Brdn Total	Total	Full Rate
FOREMAN	1	17.15	$30.00	$514.50	30%	$154.35	$668.85	$39.00
JOURNEYMAN	2	34.30	$25.00	$857.50	30%	$257.25	$1,114.75	$32.50
APPRENTICE	2	34.30	$15.00	$514.50	30%	$154.35	$668.85	$19.50

It is important for the estimator to be familiar with the "burden" rate that is added on top of the hourly rate per electrician and to make sure this cost is included in his/her estimate.

Each project could, and most likely will, require different crew rates. The larger projects could have one to two additional foremen. A discussion on bid day with the General Superintendants can be very advantageous for the estimator. For example, the General Superintendant can inform the estimator of certain employees that will be available for this project should it be awarded in the future. If the estimate is built around this factor, it will increase the chance of success.

The estimator is also required to know whether the project will require Prevailing Wage Rates, such as for a government facility. If so, the estimator should familiarize himself with the Davis Bacon Act. This document will instruct him on the hourly rate required to pay, as well as the "fringe benefits".

Material

Accurately estimating the cost of materials for most projects can be difficult. With the daily ups and downs in the commodity markets, a good estimate can go south overnight. The job of an estimator is to get the best price of his/her material on bid day and consider the following; when will this project be awarded? This answer can determine how aggressive the estimator can be with the materials. It is recommended a note be added to the scope letter indicating the electrical proposal is good for 30 days, which is standard.

Equipment

For every project careful consideration should be given to what type of lifts will be required and how many lifts will be needed to successfully meet critical deadlines. Having the right equipment on site can lead to a successful project. For example, utilizing cranes to set the EDC instead of two sky tracks will save money and time, but greatest of all is it is safer method of installation.

Indirect Costs

Indirect costs are simply those costs not directly associated with the construction of the project, at least not 100% of the time. For example, some of the major indirect costs of a project will be the Project Manager and the General Superintendant. Neither one of these positions is located on the construction site full time, yet both are critical in the success of the project. To properly account for this cost, a percentage of hours should be included in the estimate. Projects that will require daily work from the Project Manager or weekly jobsite visits by the General Superintendant will require a higher percentage. A typical large box retail store should include 5% of the overall estimated hours for each of these positions. A typical government facility project should include 15% of the overall estimated hours.

Larger projects, those over 10,000 man hours should also consider time for a material person on site. Many hours are wasted by an electrician on a daily basis rounding up the material he/she needs to install. A material person can help alleviate these wasted hours.

Mark-Ups

A project can be deemed successful in different ways and for different reasons, but ultimately, the success of a project is determined by the profits at the end of any project. Every estimate should include mark-ups, also known as overhead and profits.

The percentage of profits that an estimator should include is based on the difficulty of the project. Some other factors that should be considered are the duration and location of the project. A 10% mark-up for overhead and 5% mark-up for profits is good starting point. Difficult projects should have increased levels.

5. Special Risk Considerations

There are several items to consider should you be awarded this project. First is the delivery of the EDC unit to the jobsite. In order to be as efficient as possible, and to maintain the profits included in the estimate, the pad for the EDC should be poured and ready to receive the EDC unit when it arrives. If the pad is not ready, and the EDC unit arrives, the only choice is to unload the EDC unit and set it off to the side with the crane. Then when the pad is ready, the crane is needed for a second time to put the EDC unit in place. This second trip for the crane, is not included in the original estimate and nor should it be, therefore it can only be paid out of the anticipated profits figured. Co-ordination with all other subs is imperative to ensure a profitable project. A second concern is that the roof of the building not be installed prior to the EDC unit arrival. If so, using a crane is no longer an option, and this will bring about additional labor hours to install the EDC unit. It is mandatory for the EC to keep up with the project to ensure it meets these critical dates of the project.

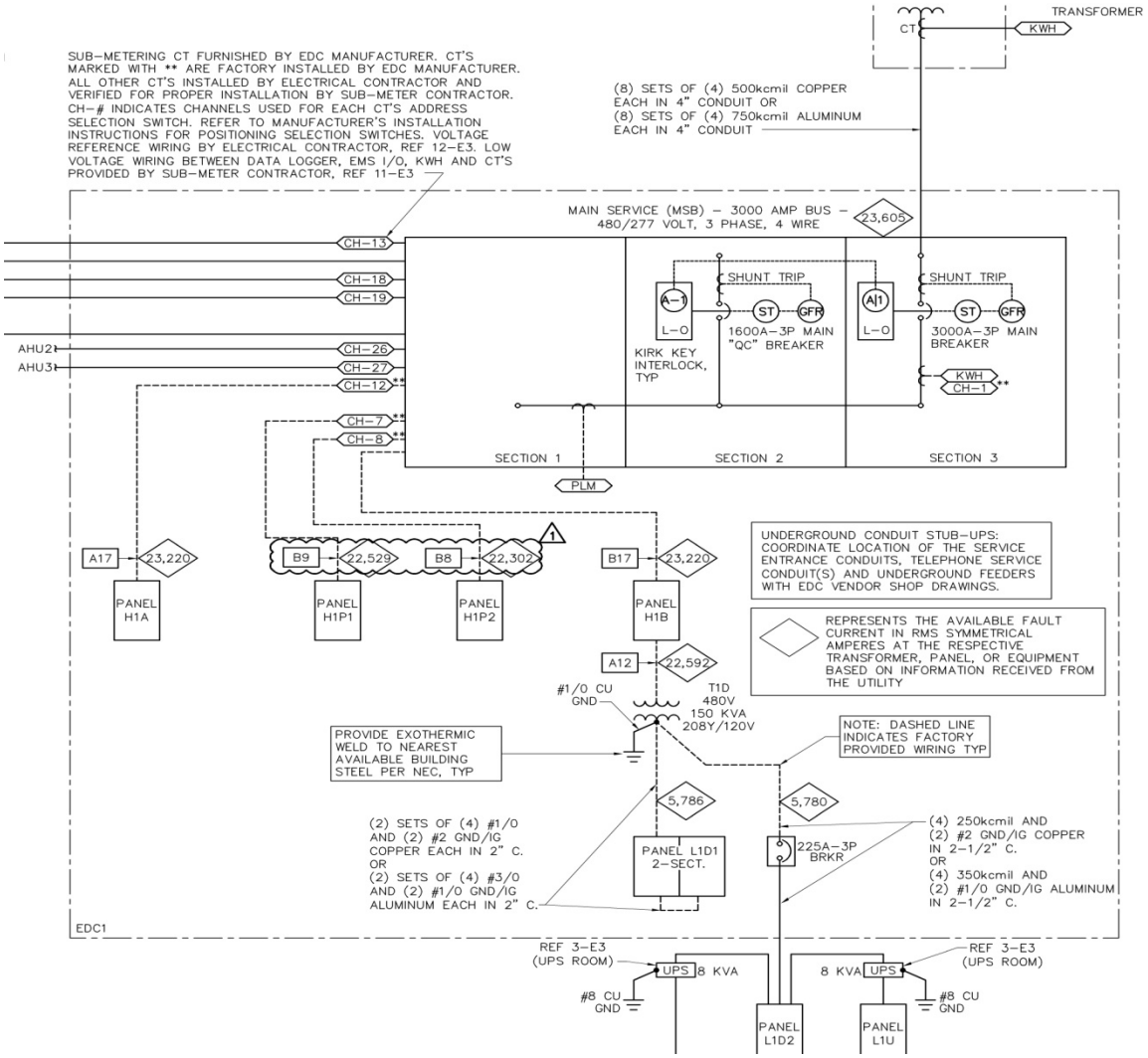
6. Ratios and Analysis

An estimate is just that, an estimate. The only method that is proven to determine an estimate's accuracy is the historical data from similar previous projects. However, it is imperative to know that even projects that are identical as far as layout, other factors should be considered. The location of the project should be considered for the delivery of materials to the jobsite in a timely manner. The General Contractor is another variable to consider. An experienced General Contractor, who maintains the schedule can increase the bottom line for a subcontractor.

7. Misc. Pertinent Information

One thing an estimator needs in order to perform an accurate estimate is time. Today many contractors are trying to bid too many projects and not allowing the estimator sufficient time for thorough bid process. Time is required in order to review all project documents including the architectural drawings.

8. Sample Sketch



9. Sample Take-Off and Pricing

Description	Qty	U	Cost	Labor	Unit	Total Mat	Total Hrs
#12 WIRE POWER TERM	240	E	0.00	0.09	E	0.00	21.60
#10 WIRE POWER TERM	130	E	0.00	0.11	E	0.00	14.30
# 8 WIRE POWER TERM	30	E	0.00	0.14	E	0.00	4.20
# 6 WIRE POWER TERM	14	E	0.00	0.17	E	0.00	2.38
# 4 WIRE POWER TERM	2	E	0.00	0.21	E	0.00	0.42
# 3 WIRE POWER TERM	2	E	0.00	0.23	E	0.00	0.46
# 2 WIRE POWER TERM	6	E	0.00	0.25	E	0.00	1.50

# 1 WIRE POWER TERM	4	E	0.00	0.29	E	0.00	1.16
#1/0 WIRE POWER TERM	8	E	0.00	0.32	E	0.00	2.56
#3/0 WIRE POWER TERM	16	E	0.00	0.39	E	0.00	6.24
#4/0 WIRE POWER TERM	6	E	0.00	0.43	E	0.00	2.58
#250 WIRE POWER TERM	4	E	0.00	0.47	E	0.00	1.88
#350 WIRE POWER TERM	12	E	0.00	0.54	E	0.00	6.48
UNLOAD EDC AND SET PLACE	1	E	0.00	16.00	E	0.00	16.00
CLEAN/WIPE DOWN EDC	1	E	5.00	1.00	E	5.00	1.00
REMOVE WP ROOF	1	E	0.00	2.00	E	0.00	2.00
REMOVE DOOR PACKAGING	1	E	0.00	1.00	E	0.00	1.00
						5.00	**85.76**

Labor Type	Crew	Hours	Rate	Sub	Brdn %	Brdn Tot	Total	Full Rate
FOREMAN	1.00	17.15	$30.00	514.50	30.000	154.35	$668.85	39.00
JOURNEYMAN	2.00	34.30	$25.00	857.50	30.000	257.25	$1,114.75	32.50
APPRENTICE	2.00	34.30	$15.00	514.50	30.000	154.35	$668.85	19.50
	5	**85.76**	**$22.00**	**1,886.50**		**565.95**	**$2,452.45**	**28.60**

Indirect Labor	Lbr %	Hrs	Rate	Total	
PROJECT MANAGER	5.000	4.29	$25.00	107.25	(Note that since these positions
GENERAL FOREMAN	5.000	4.29	$35.00	150.15	are salaried, there is no burden)
		8.58	**$30.00**	**$257.40**	

Equipment	Qty	Hrs	P/Hr	Total
CRANE - 10 TON (per Hour)	1.00	4.00	$200.00	$800.00

Final Pricing	**Value ($)**
Database Material	**5.00**
Material Tax-9%	**0.45**
Material Total	**5.45**
Direct Labor	**2,452.45**
Indirect Labor	**257.40**
Labor Total	**2,709.85**
Equipment	**800.00**
Total Cost	**3,515.30**
Overhead-10%	**351.53**
Subtotal	**3,866.83**
Profit-5%	**193.34**
Selling Price	**4,060.17**

10. Glossary

EDC or Electrical Distribution Center: a preassembled unit of a certain ampacity that may include 480V panels, step down transformers, 208V panels, communication boards, lighting, and receptacles. All items are pre-wired from the EDC manufacturer's facility and shipped complete to any location.

Loose Switchgear: any panel, 480V or otherwise, that is not included within the EDC unit.

AHU: Air Handling unit

Feeders: the conduit and wiring that is installed from one panel or power source to another. Feeders can be installed underground or overhead.

GRC 90: GRC is an acronym, it stands for Galvanized Rigid Conduit. 90 is a term used in the routing of a feeder. The conduit feeder turns 90 degrees. A GRC 90 is a fitting that is used on larger conduits in lieu of bending the conduit to 90 degrees.

General Superintendant: a position within an organization who oversees numerous projects at a time. A jobsite Superintendant will work directly for a General Superintendant.

Fringe Benefits: is the compensation to employees in addition to their hourly rate of pay. The fringe benefits of a project vary from one to the other and from city to city and state to state.

Overhead: simply stated, overhead is the cost of doing business on a daily basis.