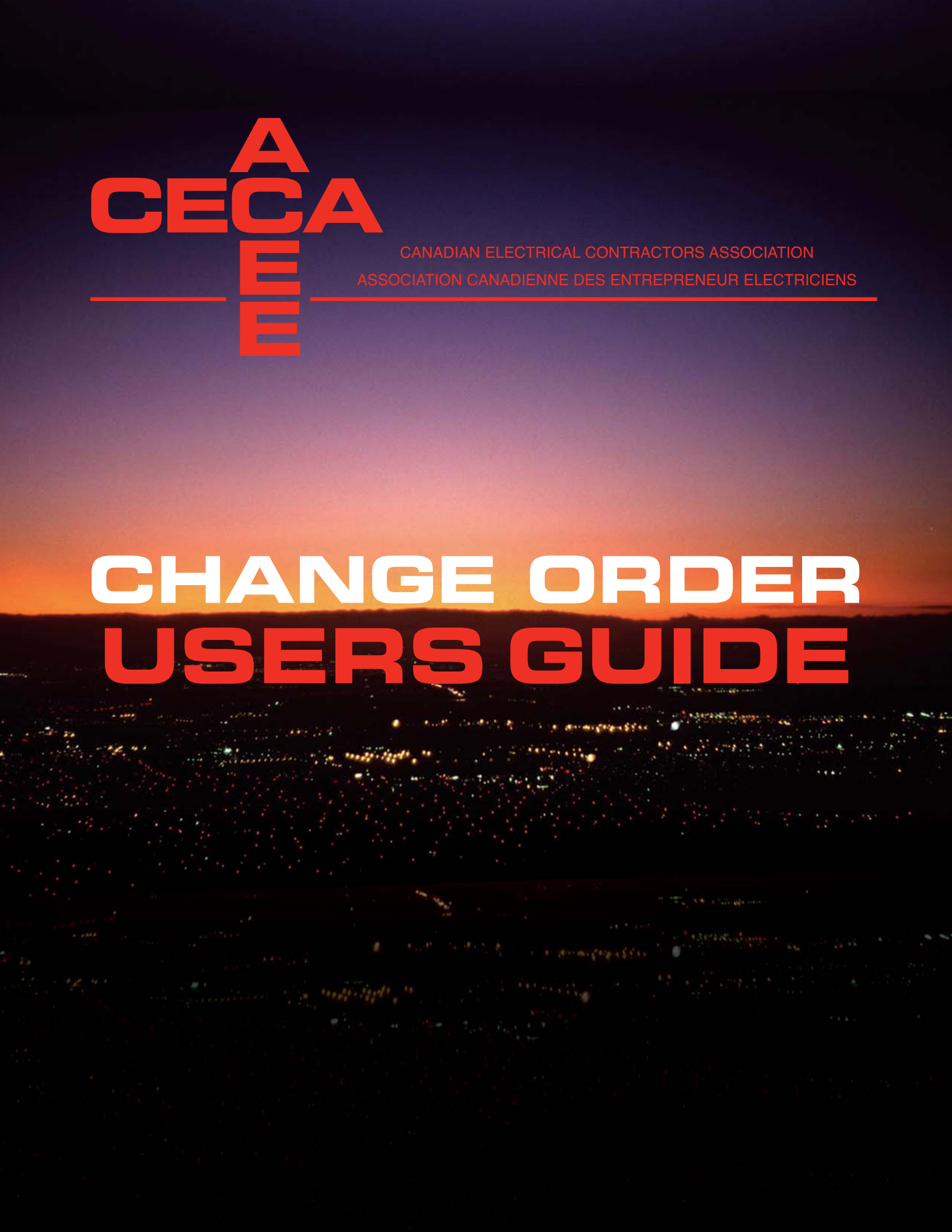

CANADIAN ELECTRICAL CONTRACTORS ASSOCIATION
ASSOCIATION CANADIENNE DES ENTREPRENEUR ELECTRICIENS

CHANGE ORDER USERS GUIDE

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INTRODUCTION [1]

Changes in projects are becoming more complicated and more costly to owners. There are many elements involved beyond direct labour and materials that enter into the estimated cost of making a change. The prudent owner will give serious consideration to these when contemplating a major change.

The cost of making changes depends upon the magnitude of the change, the timing, scheduling, etc. While small changes may not be expensive individually, a large number of small changes on the same job can become extremely expensive. This is mainly due to the disruption of the job schedule and manpower requirements necessary to maintain the contract completion date.

It should be understood that at the time of starting the project, the contractor has established some sort of progress schedule which his firm will maintain. This also includes manpower scheduling, tool requirements, supervision, etc. Changes of any magnitude will disrupt his scheduling. If time extensions are not allowed, the contractor has three alternatives - work the change into the present schedule, overman the project, or go into overtime.

Striving to work the changes into his present schedule is unrealistic in most cases. Overmanning the project entails much more than assigning additional manpower to the project. It also involves the need for additional tools, more supervision, higher overhead cost etc. Working crews on an overtime basis over an extended period of time has proven to be disastrous to productivity. This is mainly due to the fatigue factor. Should the contractor be required to complete change orders using any of the above three alternatives, it can readily be seen that the cost to the owner could be considerably higher than if a time extension had been allowed.

The contractor must recover his costs when completing a change order and low-productivity factor will increase the cost of making the desired change. This is important to the owner as he will eventually pay the cost of the low productivity.

If due to changes, installations or systems must be removed and reinstalled, it has an adverse effect on the workmen's morale. Most workmen take pride in their work, so morale has a great deal to do with productivity.

[1] This guide is based on the *ECAO Change Order Guide*, 1985.

Because a great deal of time is involved by all parties concerned when changes are made to the original contract drawings; by understanding these procedures, the owner will be enlightened as to the true costs of making changes.

The close cooperation between owners, architects, engineers, general contractors and specialty contractors is an absolute must in this modern day of construction. Only through a thorough understanding of construction procedures, industry problems and cooperation can this industry continue to prosper and satisfy the structural needs of government and the public.

CHANGE DIRECTIVE

Changes may be required because of site conditions, Owner's requirements or government regulations.

When an order requires a change in the work, and there is not enough time, or failure of the parties to reach a price, the Owner may issue a Change Directive. Under a CCDC-2 contract, the Contractor must proceed promptly with changes in the work upon receipt of a Change Directive.

CHANGE ORDER

A Change Order is used when the Owner and Contractor agree on the price and the change in schedule.

MATERIAL COSTS

It is important for all parties to realize that although material costs are calculable, there is a good deal of difficulty in accounting for spoilage, cuttings, additional lengths to get around obstructions, fastenings, etc., and material damaged by our forces or others due to accident, neglect or theft.

Moreover, the greater the number of changes, the greater the amount of material which will be left over at the end of the project. This material, apart from affecting the contractors cash flow, must be either stored at a cost of labour, space and financing or depleted at a considerable restocking charge.

It is furthermore noted that due to changes, the contractor loses the ability to plan and forecast his material needs on a predetermined basis.

All the above factors must be considered when one determines one's material costs.

LABOUR COSTS

A problem usually exists in estimating the labour for changes in the installation ordered by the customer or his representative after work on the job started.

The large majority of such changes involve relatively small and limited sections of the work, and therefore, extreme caution must be exercised in establishing labour units. On any job involving an excessive number of changes, the over-all efficiency of the labour drops.

The adverse effect of changes on the over-all job labour is caused by:

- Disruption of previously planned work schedules.
- Holding up a job progress pending approval of the change.

- Attitude of workers on the job.
- Tearout of electrical material already installed.
- Performing work in partially completed areas involving obstructions to the work, cutting and patching, working in confined spaces etc.
- Work being prolonged into a period of increased labour rate or into a period of adverse weather conditions as from Summer and Fall or from Fall to Winter.
- Excessive manning of the project causing reduced productivity and requiring additional supervision, tooling, material control and clerical backup.

These situations must be taken into consideration and allowances made.

Again it must be emphasized that when anyone attempts to evaluate the cost of change orders using labour units, extreme care must be exercised and the above mentioned factors must be taken into consideration.

MANHOUR CALCULATION

CECA recommends that the *NECA Manual of Labour Units*[2] be used in calculating manhours required to complete a Change Notice. Each change may have a variety of non-typical or abnormal factors that will require adjustments in these circumstances. Factors that should be considered include:

- **Installation Height** - Installations above 10 feet require extra equipment and men.
- **Multi-Story Factor** - Labour adjustment must be made for taller buildings to reflect the rate of productivity loss. (See NECA Report: *The Effects of Multi-Story Buildings on Productivity*)
- **Environment Conditions** - Extreme weather conditions either heat, humidity or cold may result in productivity loss.
- **Availability of Personnel** - When an adequate supply of personnel is not available, the loss of productivity must be taken into account.
- **Stacking of the Trades** - A change order may require many trades to perform their work concurrently and in a limited work area resulting in productivity losses. (See NECA Report: *Stacking of Trades for Electrical Contractors.*)
- **Abnormal Work Schedule** - Deviations from a normal work schedule will have an impact on labour productivity and required supervision.
- **Crew Size Inefficiency** - Changes may require the use of larger than planned workforces.

CECA recommends the use of the Labour Adjustment Chart as contained in the *NECA Manual of Labour Units.* (See Appendix "A")

[2] NECA Manual of Labour Units, 2005-2006 edition. NECA, 3 Bethesda Metro Center, Suite 1100, Bethesda, MD 20814.

[3] The above example is based on the collective agreement in Toronto, Ontario and should be modified to suit local conditions.

LABOUR RATE [3]

- **Base Rate**
  As per collective agreement
- **Vacation Pay**
  As per collective agreement
- **RRSP**
  As per collective agreement
- **Union Deductions**
  Health and Welfare
  Retail Sales Tax on Health and Welfare
  Pension
  Union Funds
  ECA Fund
  Secretariat
- **Rest Periods**
  As per collective agreement
- **Legislated Burdens**
  Employer Health Tax
  Employment Insurance
  Workplace Safety and Insurance
  Canada Pension Plan
- **Other Burdens**
  Expendable Small Tools
  Insurance
  Clean-up
  Time-keeping / Scheduling
  Material Handling
  Finance
- **Safety**
  Safety Training
  Jobsite Safety Talks
  WHMIS Information
  Health and Safety Committee

JOB EXPENSE

Job Expense items are listed below and they should be accounted for in change orders based on the extent of their applicability.

- Permits and Inspection Fees
- Supply of Tools consumed and depreciated
- Rental of Tools and Equipment
- Freight and Cartage
- Telephone (site)
- Field Office and Storage
- Room and Board and Fares
- Reproductions and Sepias
- Estimating, Drafting and Engineering
- Commissioning

IMPACT/PRODUCTIVITY COSTS

Consideration must be given to the "impact" of a change order when preparing a change notice quotation. Impact costs refer to the effect a change order may have on the rest of the project. This effect could cause delays or interruptions to previously planned work.

Quantifying the impact of a change could depend on the size of change, whether it is near the beginning or the end of the project, and whether there is a cumulative impact as a result of a number of changes.

Some impact/productivity factors that affect the completion of the project include:

- **Fatigue** - Overtime may be required to complete the base contract work. Overtime lowers work output and efficiency through physical fatigue.
- Redirection of Workforce - A change is disruptive to the flow of work at the site. Workers may need to be re-directed and new workers may be brought in requiring an orientation and familiarization period. This could also lead to inefficiency of crew sizes.
- **Purchasing/Material Handling** - A change is disruptive to purchasing and delivery and storage of material on the site.
- **Stacking of Trades** - A change can transform an orderly, sequenced work plan into one where many operations of different trades must be performed concurrently. In completing the base contract, several trades could be stacked in a limited work area creating inefficiencies.
- **Dilution of Supervision** - Site activities required with integrating change order work into the work of the base contract diverts supervisory attention away from the base work.
- **Time Modifications** - An extension of the schedule due to changes will result in additional costs for the base contract. An extension may also cause the base contract to extend into a new labour agreement period. Extensions will also cause additional costs for the financing of holdbacks.

OVERHEAD

- **Profit** - Profit is the principle reason for doing business. Profit provides the contractor with Retained Earnings as a hedge against lean years in our cyclical industry, as well as a means for expansion and diversification. It must also cover the contractor for errors in establishing his operating costs, for errors in preparing his estimates, and provide the contractor with funds to deal with unforeseen labour problems; either one of which if in error, can place a company in perilous circumstances.
- **Costs For Review of Change Orders** - All change orders which have been either priced or reviewed by the electrical contractor have cost him something, whether they are subsequently implemented into the work or not.

  If change orders are priced, they take up estimating, foreman and electrical time. If they are approved, this time is paid for. If they are not approved, this becomes an expense to be accounted for.

  If change orders do not affect the electrical contractor's costs directly, but must be reviewed by him for coordination of information, additional time must be spent by the coordinator, estimator, supervisor and foreman and this becomes an expense to be accounted for.

Although overhead or operating cost varies from contractor to contractor depending on his size and method of operations, the following checklist may be used for you to determine your own particular operating cost.

Administrative salaries _____

Engineering, estimating _____

General office, accounting, bookkeeping, costing, filing, telephone operators etc. _____

General warehouse, storemen, shop mechanics _____

Rent, office and warehouse _____

Light, telephone _____

Office equipment, furniture _____

Supplies, stationery, postage _____

Business taxes, licenses, legal expense _____

Advertising _____

Insurance on equipment _____

Autos, miscellaneous, promotion expense _____

Financing and bad debts _____

Reserve _____

General overhead _____

CHANGE ORDER SUMMARY

To consolidate and summarize a Change Order the following sample format may be used as your final summary and tally sheet.

Material costs (including federal sales tax) _____

Provincial Sales Tax and Duty _____

Total material costs _____

Total labour costs as determined by multiplying the labour units _____

Job expenses _____

Cost for review of change order (if applicable) _____

Overhead _____

Profit _____

TOTAL COST OF CHANGE ORDER _____

APPENDIX "A"

Taken from the *NECA Manual of Labour Units*

Grade 1 point: Normal or not applicable
2 points: Difficult
3 points: Very Difficult

If your project total score is:
34 to 45 points = Normal Project
46 to 75 points = Difficult Project
76 to 102 points = Very Difficult Project

LABOUR ADJUSTMENT CHART

SITUATIONS	NORMAL	DIFFICULT	VERY DIFFICULT	NOTES	GRADE
Hours Worked	40	50	Over 50		
Shifts	Day	2nd Shift	3rd Shift		
Job Documents	Standard	Poor	None		
Working Conditions	Indoor with controlled environment	Indoor not controlled Outdoor (moderate)	Extreme weather		
Crew Density	Normal	Moderate	Extreme		
Working Height	Up to 10'	10'-20'	20' and up		
Floors	0-3	4-7	8 and up		
Job Duration	Normal for Project Size	Larger for Project Size	Shorter for project Size		
Bldg Sq. Ft.	Up to 20K sq'	20-100K sq'	Over 100K sq'		
Proj. Size	Up to $100K	$100K-750K	Over $750K		
Site Size	1 acre or less	2-5 acres	6 acres & over		
Safety	Standard	Moderate	Extreme		
Job Condition	New construction	Remodel	Work while occupied		
Clean-up	Routine	"No Dust"	"Clean Room" Condition		
Installation	Repetitive	Moderate Repetitive	No Repetition		
Type of Construction	Frame	Block	Concrete or Exposed		
Systems	Common	Special	Complex		
Conduit Type	PVC, EMT, Flex	Rigid, IMC, Alum.	PVC Coated Rigid		
Project Access	Unlimited	Limited	Escorts		
Voltage	0-600V	600V-5KV	Over 5KV		
Tools/Equipment	Standard	Non-standard	Specialty		
Craft Co-ordination Required	Minimum	Moderate	Maximum		
Labour Base	Readily Available	Moderately Available	Not Available		
Information Flow	Timely	Delayed	Limited		
Decision Making	Timely	Delayed	Limited		
Job Continuity	No interruptions	Moderate Interruptions	Extreme Interruptions		
Change Order Quantity	Minimal	Moderate	Excessive		
Change Order Timing	Prior to Installation	During Installation	After Installation		
Job Schedule	As Planned	Moderately Compressed or Extended	Excessively Compressed or Extended		
Job Meetings	Regularly Scheduled	"Crisis" Meetings	Minimal		
Project Total Score					

By utilizing the scoring process you will be able to utilize the labour unit categories as you prepare, or review your electrical estimate.

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