Security Systems Installer
(Electrician Specialization)

Occupational Analysis Report

July 2009

The purpose of this report is to describe as accurately as possible the trade of security system installer as currently practiced in the Quebec construction industry. The report describes the discussions held by a group of workers who met for the occasion and were referred to the Commission de la construction du Québec (CCQ) by industry partners for their expertise in the trade.

The occupational analysis is a first step in defining the qualifications required of workers in the trade. This report becomes one of the reference and decision-making tools used by the CCQ for teaching and learning purposes.

The Commission de la construction du Québec (CCQ) is not legally responsible for this report. The latter has no legal effect and is intended solely to reflect the discussions held on the date of the analysis workshop.

PRODUCTION TEAM

The Commission de la construction du Québec wishes to thank the production team for this occupational analysis.

The masculine gender is used generically
in this document to facilitate reading.

ACKNOWLEDGEMENTS

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The CCQ extends special thanks to the Commission de la santé et de la sécurité du travail and its representative, Mr. Gaston Dufour, for their collaboration in producing the occupational health and safety grids appended to the present report.

APPROVAL

This occupational analysis of the trade of Security systems installer was read and approved by the following organizations and persons on the dates mentioned below.

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February 18, 2010

Board of Directors
March 24, 2010

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INTRODUCTION

In early 2009, the CCQ's Direction de la formation professionnelle launched a large-scale operation to review the occupational analyses[1] of all construction trades.

The CCQ undertook this operation mainly for the following reasons:

- the project to reform the construction workforce apprenticeship and management system, and the eventual design of qualitative apprenticeship booklets requiring a detailed description of each trade;

- the fact that most construction occupational analyses[2] had been conducted between 1987 and 1991 and had not been reviewed since;

- updates to vocational qualifying examination question banks;

- implementation of Chapter 7 of the Agreement on Internal Trade (AIT) and of the Québec-France Understanding on the Mutual Recognition of Professional Qualifications.

These factors demonstrate the necessity of performing occupational analyses in order to obtain a current and complete provincial profile of the various trades.

The occupational analysis for elevator mechanics belongs to this context.[3] Its purpose is to describe the trade as currently practiced in the construction industry. The present report was written in order to collate and organize the information gathered during the occupational analysis workshop held in Laval on April 27 and 28, 2009.

This analysis aims to draw a realistic and complete portrait of the trade of a journeyman security systems installer. It describes the tasks, operations and conditions of the trade, as well as the behaviours required. The report of the occupational analysis workshop is an accurate reflection of the consensus reached by a group of workers in the trade. A special effort was made to include all the data collected during the workshop and to ensure that the data accurately depict the reality of the trade analysed.

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1. The terms "profession" and "trade" are used indistinctly.
2. Occupational analyses were then called "work situation analyses".
3. This occupational analysis was conducted according to the *Cadre de référence et instrumentation pour l'analyse d'une profession* produced in 2007 by the ministère de l'Éducation, du Loisir et du Sport (Direction générale de la formation professionnelle et technique) and the Commission des partenaires du marché du travail, ministère de l'Emploi et de la Solidarité sociale.

1. GENERAL CHARACTERISTICS OF THE SPECIALTY

1.1 DEFINITION OF THE SPECIALTY

According to the Regulation respecting the vocational training of workforce in the construction industry (Sched. A, sec. 21), the term "security systems installer" means:

> "[…] anyone who performs installation, overhaul, alteration, repair and maintenance work on various security systems such as fire alarms, burglar alarms, access cards and video cameras, excluding electrical installations defined in paragraph 3 of section 2 of the Act respecting electrical installations (R.S.Q., c. I-13.01).

> "The work described to be within the jurisdiction of a security systems installer does not include the installation of conduits or of cables inside conduits, unless such work is to be performed within one day and requires the use of less than 150 metres of conduit and the installation of cables inside such conduit.

> "Performance of the work described above includes trade-related handling for the purposes of immediate and permanent installation."

1.2 JOB TITLES

To describe the speciality of security systems installer, other job titles are used in the industry, such as:

- technician;
- security systems technician;
- installation technician;
- service technician.

In the participants' view, the title "security systems technician" is most commonly used. They see it as more inclusive, given that their work is not limited to installing security systems. However, in the present report, the title chosen is "security systems installer" (or, on occasion, "installer", to lighten the term), because it is used in the Regulation respecting the vocational training of workforce in the construction industry.

Job titles not to be confused with that of security systems installer include: "electrician", "wirer[4]" and "interior systems installer".

1.3 SECTORS OF ACTIVITY

Security systems installers are active mainly in three of the four construction industry sectors, but to various degrees. The diagram below illustrates the work time allocation among all security systems installers in Quebec for 2008[5]. We note that the institutional and commercial sector provides almost all the hours worked by security systems installers.

Worked Hours Distribution per Construction Industry Sector

Residential
6 %

Industrial
2 %

Institutional &
commercial
92 %
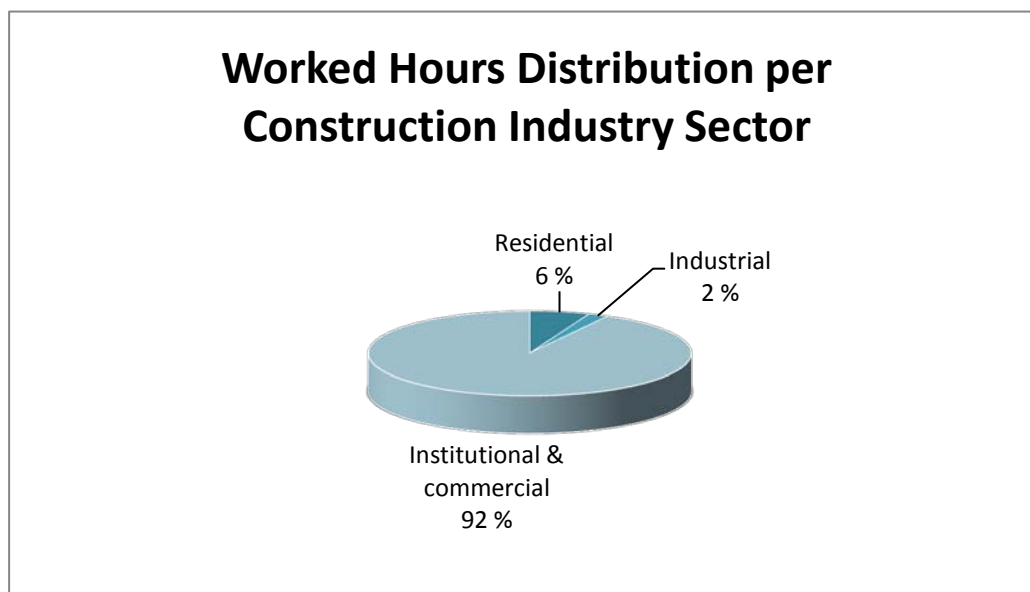
However, the security systems installers who participated in the workshop have a different view of the allocation of hours worked by security systems installers for this year. According to the participants, the percentages more closely resemble the following:

- 25 to 50% of the working hours were spent in the residential sector; the participants explain this difference by the fact that some of the hours worked by security systems installers are excluded from the application of the R-20 Act under its section 19, 9°;

- Fewer hours are worked in the institutional and commercial sector.

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4. Television cable company employee.
5. Commission de la construction du Québec, *Carrières construction*, 2008-2009 edition.

1.4   FIELD OF PRACTICE

The trade's area of practice is the construction industry. The *Act respecting labour relations, vocational training and workforce management in the construction industry* (R.S.Q., c. R-20) defines construction as follows:

> "[…] the foundation, erection, maintenance, renewal, repair, alteration and demolition work on buildings and civil engineering works carried out on the job site itself and vicinity including the previous preparatory work on the ground.

> "In addition, the word 'construction' includes the installation, repair and maintenance of machinery and equipment, work carried out in part on the job site itself and in part in the shop, moving of buildings, transportation of employees, dredging, turfing, cutting and pruning of trees and shrubs and laying out of golf courses, but solely in the cases determined by regulation."

Depending on the work to be done, security systems installers practice in the "construction" or the "out of construction" sector. They work for security, electricity[6], consulting, service and installation companies, etc.

1.5   LEGISLATION AND REGULATIONS

Construction industry security systems installers are subject to:

- the Act respecting Labour relations, vocational training and workforce management in the construction industry (R.S.Q., c. R-20);
- The Regulation respecting the vocational training of workforce in the construction industry (R-20, r.6.2)
- the four sector-based collective agreements for the construction industry;
- the National Building Code – Canada 2005 (NBC);
- the Quebec Building Code, Chapter I, "Building";
- the Act respecting occupational health and safety (R.S.Q., c. S-2.1);

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6. Some of these companies develop expertise in security systems.

- the Safety Code for the construction industry (R.Q. c. S-2.1, r.6).

- to Bill 88 (2006, chapter 23), Private Security Act;

- to CAN/ULC standards[7], such as:

    - Electronic Access Control Systems (CAN/ULC-S319-05);

    - Installation and Classification of Residential Burglar Alarm Systems (CAN/ULC-S310);

    - Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults (CAN/ULC-302);

    - Installation of Fire Alarm Systems (CAN/ULC-S524);

    - Inspection and Testing of Fire Alarm Systems (CAN/ULC-S536);

    - Verification of Fire Alarm Systems (CAN/ULC-S537);

    - Etc.

1.6 WORKING CONDITIONS

The following data give an overview of the working conditions and context of security systems installers, as commented by participants in the occupational analysis workshop. Please refer to the four collective agreements of the construction industry's sectors to obtain up-to-date and complete information that has legal effect.

Salary[8]

A journeyman's hourly wage varies slightly according to the sector. For 2008, it is as follows:

- Industrial, institutional and commercial: $25.27

- Civil engineering and roadwork: $25.62

- Residential (light): $23.23

- Residential (heavy): $25.61

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7. *Underwriters Laboratories of Canada.*
8. Salary data are taken from the following document, published by the Commission de la construction du Québec: *Carrières construction*, 2008-2009 edition; and from the 2007-2010 collective agreements.

Vacations and time off[9]

Mandatory annual holidays of four weeks – two weeks in summer and two in winter at periods predetermined in collective agreements – are the general rule in the construction industry. To avoid penalizing employers and employees experiencing special constraints, the industry's four collective agreements allow certain possibilities for changing the vacation periods prescribed by the general rule.

To these vacation periods are added eight not paid statutory holidays, as well as a lump sum for sick leaves not otherwise paid.

Pension plan

Construction industry workers participate in a pension plan. They retain their eligibility for this pension plan throughout their career in construction, even if they change employer, trade or sector

Insurance

The group insurance plan (medications, illness, disability, death) is fully paid by employers. Workers (and their families, as the case may be) are eligible for it so long as they remain active in the construction industry and work the required number of hours, whether or not they change employer.

Physical requirements

The security systems installer's work requires endurance, a good physical condition and a certain strength, to lift and move relatively heavy loads (e.g.: ladders, wire boxes, etc.). The security systems installer often works in extreme ambient temperatures; for instance, he may have to work outdoors in frigid weather.

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9. Data on vacations and time off, the pension plan and insurance are taken from the following document, published in 2009 by the Commission de la construction du Québec: *La construction au Québec : c'est bien plus payant!*

Work schedules

A 40-hour work week from Monday to Friday is the general in all construction industry sectors. The daily limit is 8 hours per day, except in light residential construction, where it can reach a maximum of 10 hours within a 40-hour work week.

To avoid penalizing employers and employees experiencing special constraints, the industry's four collective agreements allow many possibilities for changing the vacation periods prescribed by the general rule: compressed schedule, schedule shift, make-up time in light residential construction, etc. These special schedules confer flexibility to the work schedules in effect in the construction industry.

Generally, the work schedule of security systems installers is 8 a.m. to 5 p.m., Monday to Friday. They can also have various schedules (evening or night) and be on standby to respond to emergencies at any hour of the day or night. Installers are regularly called upon to do overtime in order to complete work. The working hours can often extend beyond the usual schedule. After beginning certain types of work, the installer cannot leave them unfinished at 5 o'clock sharp and return to finish up the next morning, because he must not leave the premises before the building is secured, which at times can take longer than expected.

1.7   JOB MARKET ENTRY CONDITIONS

To obtain a competency certificate-apprentice in a construction industry trade, candidates must first[10]:

- provide proof that they are at least 16 years old;

- provide their social insurance number and their home address;

- present their certificate for having passed the course *Santé et sécurité sur les chantiers de construction*;

- pay the required fee;

- designate the union association that they wish to join.

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10. http://www.ccq.org/E_CertificatsCompetence/E02_Apprenti.aspx?sc_lang=en&profil=GrandPublic.

In addition, candidates who hold a recognized diploma[11] (DEP, AEC or DEC) must[12] :

- present the original version of an academic transcript or apprenticeship transcript attesting that they have graduated (the diploma is not an acceptable document);

- present an employment confirmation from an employer registered with the CCQ, for at least 150 hours over a period of at most three consecutive months.

The candidate who meets these conditions then receives a competency certificate-apprentice (CCA) in the trade of <u>electrician</u>.

Although the construction industry favours graduates for access to the trade, labour shortages may at times make it necessary to give candidates without a diploma access to the electrician trade. Accordingly, candidates without a diploma[13] are eligible for a competency certificate-apprentice only during a labour shortage and must[14]:

- Supply proof that they have the academic prerequisites for the program leading to a vocational studies diploma (DEP) in the trade referred to in the application or pledge, by signing a consent letter, to take the necessary training to obtain those academic prerequisites;

- present an employment confirmation during a labour-pool opening by an employer registered with the Commission de la construction du Québec (CCQ), for at least 150 hours over a period of at most three consecutive months[15].

The apprentice electrician must complete the three apprenticeship periods of 2,000 hours each (6,000 hours total) in security systems installation, in order to be eligible for the provincial qualification examination that leads to obtaining the competency certificate-journeyman in the specialty of security systems installer[16]. Hour credits are paid into the apprenticeship record book of an apprentice electrician who has graduated.

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11. Recognized programs for obtaining a competency certificate-apprentice in the trade of electrician are a DEP in electricity, construction electricity and security systems installation, as well as many college diplomas and certificates in electrical engineering (09).
12. http://www.ccq.org/E_CertificatsCompetence/E02_Apprenti/E02_3_CandidatDiplome.aspx?sc_lang=en&profil=GrandPublic.
13. Of the 11 participants in the workshop, six began practicing the trade without training. However, these participants entered the trade before 1995. It should be noted that prior to 1995, there was no specific training in the specialty.
14. http://www.ccq.org/E_CertificatsCompetence/E02_Apprenti/E02_6_CandidatNonDiplome.aspx?sc_lang=en&profil=GrandPublic.
15. The CCQ must have received the employee's complete file within 14 working days following the date of reservation of a place authorized by an employer in a situation of labour shortage and labour-pool opening, in order for the employee to obtain the competency certificate applied for.
16. A journeyman security systems installer may pursue his training and obtain a journeyman electrician certificate.

In addition, certain qualities are sought by employers hiring new security systems installers. The following list presents the main qualities, in the order in which they were mentioned and not in order of importance:

- autonomy and initiative;
- dexterity;
- diplomacy;
- reasoning ability;
- interpersonal skills;
- versatility;
- using tools and measuring instruments correctly;
- basic knowledge of construction, particularly regarding building structures, the building code, plans and specifications, etc.;
- computer, network and electronics skills;
- knowledge of English and French;
- no criminal record[17];
- holding a driver's licence.

1.8 PLACE OF WOMEN IN THE SPECIALTY

Section 126.0.1 of the Act respecting labour relations, vocational training, and manpower management in the construction industry pertains to women's access to the construction industry: "The Commission, after consultation with the Commission des droits de la personne et des droits de la jeunesse, shall develop measures to favour the access of women to and their maintenance and greater representation on the labour market in the construction industry."

According to the CCQ[18], the proportion of women active in the specialty of security systems installer is 1.8% (19 women out of 1,062 installers in 2007). The participants offered various possible explanations for why very few women practice the specialty, notably:

- women's general lack of interest in computers and electronics;

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17. In certain cases (particularly for work in the banking sector or certain companies), a criminal background check must be conducted.
18. Commission de la construction du Québec, *Carrières construction*, 2008-2009 edition.

- highly variable schedules that make work-family balance difficult[19];

- working exclusively with men;

- the physical strength necessary to carry the equipment.

It was mentioned that within companies, women who hold a competency certificate in the specialty often hold inspection or office positions related to the dispatching of workers.

1.9 CAREER PROSPECTS

With experience and depending on their fields of interest, security systems installers can be promoted to positions of team leader, supervisor, manager, consultant for organizations related to the specialty, or salesperson. They can also become contractors.

The participants reported the difficulty of finding qualified workers in this field. They added that generally, security systems installers have employment stability and remain in the service of the same company for several years. When a security systems installer changes employer, it is generally because he is offered a higher salary or better working conditions.

1.10 DEVELOPMENT OF THE SPECIALTY

There are constantly new developments in this field, particularly concerning computers and electronics. Indeed, the configuration of networks and equipment is more and more complex. The participants emphasize that demand is growing for new products, the integration of new systems (e.g.: monitoring, fire alarm and access control systems) and the integration of a new system to an existing one.

The participants mentioned the importance of updating their knowledge, given the many technological advances in their specialty. Installers are required to take professional development courses, which are generally offered by suppliers.

Finally, the participants noted that occupational health and safety standards are more and more strict, in several cases requiring specific training (e.g.: in the use of a boom lift).

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19. In this regard, a participant added: "We know when we'll start, but not when we'll finish".

1.11 IMPACT OF ENVIRONMENTAL STANDARDS ON THE PRACTICE OF THE SPECIALTY

In this regard, the participants observed that changes have taken place in the field of security systems generally, but without any direct effect on the work of installers. For example:

- wafers now contain little or no lead welds;

- some clients request (or require) that security systems (or parts) that are removed are not thrown away, but recycled[20];

- some companies, when replacing their vehicles, purchase smaller truck models than previously, for fuel efficiency purposes;

- etc.

Moreover, a few other changes have an effect on the work of installers. For example:

- installers must now keep all used batteries and avoid throwing them away; they hand them to their employers, who must dispose of them in accordance with environmental regulations;

- when installers notice the presence of asbestos in walls, ceilings or other structures on a client's premises, they are obliged to notify those responsible and end their own work.

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20. However, security companies may have difficulty meeting those requests, since recycling centres are few and not always accessible. Some companies pay subcontractors to recycle or dispose of hazardous materials.

2. WORK DESCRIPTION

2.1 TASKS AND OPERATIONS

List of tasks

The following list presents the main tasks performed by security systems installers. The order in which the tasks are presented does not necessarily reflect their importance in the specialty.

Task 1   Install systems[21]

Task 2   Link systems[22] to a monitoring station

Task 3   Inspect systems[23]

Task 4   Modify systems

Task 5   Repair and service systems[24]

Task 6   Deal with clients

Table of tasks and operations

During the workshop, a table of tasks and operations produced by security systems installers was submitted to the participants. Following discussions, changes were made to the table. The final version is presented in the following pages.

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21. To the extent that they are considered building machinery or are installed by construction employees working for a professional employer, they may be fire alarm, emergency communication, sprinkler monitoring, access control, fire-retardant, video monitoring, antitheft, voice communication, electronic marking, synchronized timekeeping, signal reception, or local control systems.
22. The systems of tasks 2, 3, 4 and 5 are the same as those of task 1.
23. Tasks 3 and 6 are not subject to Regulation #1.
24. Task 5 is subject to Regulation #1 only when it is performed by construction employees working for a professional employer.

Table 2.1   Tasks and Operations

TASKS	OPERATIONS					
1. **INSTALL** **SYSTEMS**	1.1 Examine the work to be done	1.2 Prepare one's equipment and tools	1.3 Examine the site	1.4 Plan the work	1.5 Install cables with raceways	1.6 Install cables without raceways
	1.7 Assemble and install the main panel	1.8 Install peripheral components	1.9 Make the connections	1.10 Program components, if applicable	1.11 Turn the system on	1.12 Check the system and its components
	1.13 Integrate systems, if applicable	1.14 Test the system with the monitoring station and the concerned authorities, if applicable	1.15 Clean the premises	1.16 Provide a certificate, if applicable	1.17 Train the clients	1.18 Design or update system plans
	1.19 Report information about work done					
2. **LINK SYSTEMS TO A MONITORING STATION**	2.1 Plan the work	2.2 Make the necessary connections	2.3 Activate the communications network	2.4 Program components, if applicable	2.5 Turn the system on	2.6 Check the system and its components
	2.7 Clean the premises	2.8 Check the call list of the services and persons responsible	2.9 Train the clients	2.10 Update system plans	2.11 Report information about work done	
3. **INSPECT** **SYSTEMS**	3.1 Plan the work	3.2 Notify the monitoring station and the concerned authorities of system tests	3.3 Check the good operation of components	3.4 Test and confirm received signals with the concerned authorities	3.5 Reactivate the system	3.6 Write the inspection report

TASKS	OPERATIONS					
4. **MODIFY SYSTEMS**	4.1 Plan the work	4.2 Notify the monitoring station and the concerned authorities of system tests	4.3 Perform required alterations	4.4 Check and program components, if applicable	4.5 Notify the centre and the concerned authorities of the changes made	4.6 Clean the premises
	4.7 Train the clients	4.8 Design or update system plans	4.9 Report information about work done			
5. **REPAIR AND SERVICE SYSTEMS**	5.1 Notify the monitoring station and the concerned authorities of system tests	5.2 Select necessary tools and equipment	5.3 Disconnect audio alarms, if applicable	5.4 Check the equipment and the environment	5.5 Make a diagnosis	5.6 Effectuer les opérations de réparation ou d'entretien
	5.7 Check the system and its components with the monitoring station and the concerned authorities	5.8 Reconnect audio alarms	5.9 Use the audio alarms to check the entire system	5.10 Reactivate the system with the monitoring station and the concerned authorities	5.11 Clean the premises	5.12 Explain the work done to the clients
	5.13 Update system plans	5.14 Report information about work done				
6. **INTERACT WITH THE CLIENTS**	6.1 Respond to service calls	6.2 Plan meetings with the clients	6.3 Introduce oneself to the clients	6.4 Collect information from the clients	6.5 Inform the clients of the problems detected and the work to be done	6.6 Estimate the cost of minor work
	6.7 Assist the vendor with a proposal	6.8 Provide a technical assessment of problematic events	6.9 Confirm the work done to the clients			

2.2 OPERATIONS, SUB-OPERATIONS AND CLARIFICATIONS

The following pages present sub-operations related to each operation[25], as well as a few clarifications expressed by the participants.

Table 2.2 Sub-Operations and Clarifications regarding Operations

TASK 1 INSTALL SYSTEMS

Operations	Sub-Operations	Clarifications
1.1 Examine the work to be done	1.1.1 Compare the contract's requirements with the equipment provided 1.1.2 Read the specifications to meet the equivalency request, if applicable 1.1.3 Find out the scope of the work in relation to the plans and specifications 1.1.4 Determine what, in the plans and specifications, pertains to the installation	To examine the work to be done, the installer mainly consults the work order (also called "work sheet" and "job ticket"). He can also consult either excerpts from plans and specifications related to the work to be done, or the vendor, to find out the exact meaning of agreements with the clients.
1.2 Prepare one's equipment and tools	1.2.1 Check the list of equipment necessary to do the work 1.2.2 Make sure to have the necessary equipment and tools 1.2.3 Check the condition of tools 1.2.4 Visually check the equipment provided (type of card, strike, lock, etc.) 1.2.5 Plan for the various necessary types of cabling 1.2.6 Plan for pipes and accessories, if applicable	According to the work order and the plans and specifications, the security systems installer ensures that the necessary materials and equipment for the installation is available to him and in good condition (clothing, safety equipment, harnesses, etc.).
1.3 Examine the site	1.3.1 Tour the premises with the person responsible 1.3.2 Find out the physical conditions of installation 1.3.3 Check environmental and personal safety hazards	The security systems installer accompanies the vendor or project leader, to check the premises' physical conditions. Sub-operation 1.3.1 is mainly performed during large-scale work (industrial sector, institutional and commercial sector).

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25. The sequence of operations may vary according to company organization.

TASK 1 INSTALL SYSTEMS

Operations	Sub-Operations	Clarifications
1.3 Examine the site (*Cont'd*)	1.3.4 Plan for the type of cabling installation (concealment, suspended tile ceilings, wall and floor thickness) 1.3.5 Plan for the distances to cross (wire stroke length) 1.3.6 Check whether the power supply is adequate 1.3.7 Check the telephone line, if applicable 1.3.8 Check the compatibility of computer equipment, if applicable 1.3.9 Check whether the premises are up to standards, if applicable 1.3.10 Determine the need for specific equipment (special tools, portable monitors, etc.)	Environmental and safety hazards may be related, for example, to the presence of asbestos on the work site. The installer: - checks scaffolding; - evaluates the work; - confirms the procedure, materials, equipment, components, etc.; - evaluates the required time.
1.4 Plan the work	1.4.1 Produce the electrical wiring diagram, indicating the quantity of required wires and the location of panels and junction boxes 1.4.2 Produce a schedule 1.4.3 Ensure that tools and special equipment (e.g.: scaffold, bucket truck, etc.) will be available when needed 1.4.4 Determine the location where wires or conduits are to pass 1.4.5 Classify required tasks by order of importance 1.4.6 Plan for the location of equipment 1.4.7 Prepare the workplace (lay out one's equipment so as not to hinder ongoing operations) 1.4.8 Plan for attending a job meeting, if applicable 1.4.9 Establish the clients' needs 1.4.10 Check that systems are compatible, if applicable	The security systems installer plans the required tasks by order of importance, with workers from other trades and the other persons concerned: electrician, interior systems installer, locksmith, barrier installer, security agent, representative of telephone or computer companies, representative of the computer system of the company or Internet service provider, etc. The security systems installer ensures that parts and equipment are in a secure location throughout the installation.

Operations	Sub-Operations	Clarifications
1.4 Plan the work (*cont'd*)	1.4.11 Plan safety measures	Safety measures may pertain to the following aspects: - work permits; - sanitary measures; - security perimeter; - lockout; - automatic device; - etc. In some companies, this sub-operation may take 1 to 2 hours, depending on the scale of security measures, which may require on-site training.
1.5 Install cables with raceways	1.5.1 Evaluate the number of necessary cables or wires per wiring system 1.5.2 Conceal cables or wires aesthetically 1.5.3 Measure, cut and bend the conduit, drill anchor holes, anchor supports 1.5.4 Fasten the conduit securely 1.5.5 Install service boxes and control panel housings 1.5.6 Run the cables and identify them 1.5.7 Pierce the wall or obstacle to make cables and conduits pass through 1.5.8 Connect components to the control panel and fasten cables, if necessary	The installation is done for various types of cables and conduits, and requires "… less than 150 metres of conduit and the installation of cables inside such conduit[26]."
1.6 Install cables without raceways	1.6.1 Evaluate the number of necessary cables or wires 1.6.2 Conceal cables or wires aesthetically 1.6.3 Install service boxes and control panel housings 1.6.4 Run cables and identify them 1.6.5 Pierce the wall or obstacle to make cables and conduits pass through 1.6.6 Connect components to the control box and fasten cables, if necessary	For some work, it is not necessary to install raceways.

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26. Regulation respecting the vocational training of workforce in the construction industry, Annex A, sec. 13.

TASK 1 INSTALL SYSTEMS

Operations	Sub-Operations		Clarifications
1.7 Assemble and install the main panel	1.7.1	Assemble the various modules and the other control panel parts	
	1.7.2	Calculate and measure the monitoring current and the accumulator power supply	
	1.7.3	Interconnect modules and program components according to requirements	
	1.7.4	Turn on and connect emergency batteries	
	1.7.5	Connect electrical wiring	
	1.7.6	Identify panel areas	
	1.7.7	Check the good operation of all panel functions	
	1.7.8	Configure circuit options (jumpers, switches, etc.)	
	1.7.9	Install communication integrated circuits	
	1.7.10	Fasten the control box securely	
	1.7.11	Configure the physical location of components inside the panel	
	1.7.12	Ground the panel adequately	
	1.7.13	Embed the panel, if applicable	
	1.7.14	Respect the premises' aesthetics	
	1.7.15	Use appropriate anchors	
	1.7.16	Ensure the power supply (batteries and accumulators)	
	1.7.17	Connect with the communications network, if applicable	

TASK 1 INSTALL SYSTEMS

Operations	Sub-Operations	Clarifications
1.8 Install peripheral components	1.8.1 Connect project-related components 1.8.2 Strip the wire to be connected 1.8.3 Fasten the various devices to their service box 1.8.4 Fasten components securely and flush 1.8.5 Use a microswitch to establish components' physical addresses 1.8.6 Insulate component connections well	Peripheral components are installed for access control systems, anti-theft systems, etc. Peripheral components are, among other things, signalling devices, motion sensors, GPS sensors, etc.
1.9 Make the connections[27]	1.9.1 Make the wire junctions in junction boxes 1.9.2 Ensure that wires are well stripped 1.9.3 Securely weld with the appropriate connector	
1.10 Program components, if applicable	1.10.1 Establish basic parameters (doors, scanner, controller, schedule, access level) 1.10.2 Address components 1.10.3 Use a notebook computer or any other adequate equipment to program all functions applicable to the system 1.10.4 Program all sensors with their tags 1.10.5 Program all logical associations 1.10.6 Transfer all this programming to the control panel 1.10.7 Make a backup copy of this programming and leave it at the office 1.10.8 Program the internal clock system	These are the same components as in operation 1.8.
1.11 Turn the system on	1.11.1 Supply power to the panel 1.11.2 Connect additional power supply units	

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27. Operations 1.9, 1.10, 1.11 and 1.16 are not subject to Regulation #1.

TASK 1 INSTALL SYSTEMS

Operations	Sub-Operations	Clarifications
1.12 Check the system and its components	1.12.1 Thoroughly inspect all system components 1.12.2 Calibrate detectors, perform sensitivity and trip tests 1.12.3 Check the control panel's operation (alarm, failure detection, monitor the electrical wiring, detect grounding, short circuits, etc.) 1.12.4 Check the identification (tags – field, detector, etc.) 1.12.5 Check the system's auxiliary functions 1.12.6 Check the regular or battery power supply 1.12.7 Check battery autonomy 1.12.8 Calibrate and adjust components 1.12.9 Check that components and programming match 1.12.10 Encode the units (affix the address)	
1.13 Integrate the systems, if applicable	1.13.1 Connect interfaces	Various systems may be integrated, for example an access system, an alarm and camera system, etc.
1.14 Test the system with the monitoring station and the concerned authorities, if applicable		The concerned authority may be: - a certified inspector, depending on the applicable standard; - a municipality representative; - a project leader; - etc.
1.15 Clean the premises	1.15.1 Pick up one's tools 1.15.2 Throw away waste 1.15.3 See to the recovery of batteries 1.15.4 Sweep	

TASK 1 INSTALL SYSTEMS

Operations	Sub-Operations	Clarifications
1.16 Provide a certificate, if applicable		For example, a ULC certificate.
1.17 Train the clients	1.17.1 Assemble all the users 1.17.2 Hand over relevant documents and keys 1.17.3 Explain the operation interactively 1.17.4 Explain the control functions 1.17.5 Explain the procedure in case of an alarm 1.17.6 Ask the clients to program the system for a given user 1.17.7 Check the access card with the clients and explain its operation 1.17.8 Inform the clients of the system's basic operations 1.17.9 Make sure the clients understand 1.17.10 Inform the clients of modifiable aspects	The security systems installer gives clients a demonstration, once the equipment is installed. This demonstration may be addressed to one or several persons (up to 20 or 30 participants), at the clients' discretion. The installer presents and explains all system functions. Afterward, he asks users to operate the system in his presence, so as to detect eventual errors and correct them. He hands the clients the user manual and a copy of the system plan. Generally, training lasts 15 minutes to 2 hours; training in a complex system may last 1 or 2 days. Occasionally, training extends for a few days or weeks after the initial meeting, if users have to join the installer to obtain additional information because they have forgotten or misunderstood an aspect of the system.
1.18 Design or update system plans	1.18.1 Prepare the plans necessary to the technical support department 1.18.2 Provide any relevant information about the system (location of the transformer, circuit breaker, etc.) 1.18.3 Identify junction boxes on the plan 1.18.4 Transcribe wiring codes on the plans (shop drawings) 1.18.5 Identify each unit's code 1.18.6 Correct the original plan or add an addenda to it	The obligation to hand the clients a copy of system plans is specified in the contract, if applicable. However, a few workshop participants mentioned that whether or not the contract requires it, an installer should always demonstrate professionalism in producing or updating system plans and handing them to the clients.

TASK 1 INSTALL SYSTEMS

Operations	Sub-Operations	Clarifications
1.19 Report information about work done	1.19.1 Prepare the other documents necessary to the technical support department 1.19.2 Transmit test results 1.19.3 Have the work order and any other administrative documents signed	

TASK 2 LINK SYSTEMS TO A MONITORING STATION

Operations	Sub-Operations	Clarifications
2.1 Plan the work	2.1.1 Produce the system's wiring diagram, indicating the quantity of required wires and the location of panels and junction boxes 2.1.2 Produce a schedule 2.1.3 Ensure that tools and special equipment (e.g.: scaffold, bucket truck, etc.) will be available when needed 2.1.4 Determine the location where wires or conduits are to pass 2.1.5 Classify required tasks by order of importance 2.1.6 Plan for the location of equipment 2.1.7 See if it is necessary to install surface raceways 2.1.8 Prepare the workplace (lay out one's equipment so as not to hinder ongoing operations) 2.1.9 Plan time for safety measures	For sub-operation 2.1.9, see sub-operation 1.4.11 clarifications.
2.2 Make the necessary connections		
2.3 Activate the communications network	***Activating a supervised communications network*** 2.3.1 Contact the telephone or Internet service provider and provide necessary information (network number and branch number)	Activated networks are, for example, cellular networks, IP, GSM (global system for mobile communications), DVACS, emergency interphones, etc.

TASK 2 LINK SYSTEMS TO A MONITORING STATION

Operations	Sub-Operations	Clarifications
2.3 Activate the communications network (c*ont'd*)	2.3.2 Notify the monitoring station and the concerned authorities of ongoing work and request a system test	
	2.3.3 Ensure the good connection (power supply and signal) and the good local operation of communication devices (telephone station, modem, etc.)	
	2.3.4 Program the control panel to activate the communicator and transmit signals	
	2.3.5 Perform transmission tests upon receipt of the confirmation of network activation and check the results with the monitoring station (the indicator lamps should respond)	
	2.3.6 Inform the monitoring station of the new codes generated by this system	
	2.3.7 Notify the clients and perform an actual alarm test after the control panel is closed and the work is completed	
	2.3.8 Obtain information from the monitoring station about test results	
	Activating an unsupervised communications network	
	2.3.9 Notify the concerned authorities (monitoring station) of ongoing work and request a system test	
	2.3.10 Ensure the good connection (power supply, signal and telephone line) and the good local operation of communication devices, if applicable	

TASK 2 LINK SYSTEMS TO A MONITORING STATION

Operations		Sub-Operations		Clarifications
2.3	Activate the communications network (*cont'd*)	2.3.11	Program the control panel to activate the communicator and transmit signals	
		2.3.12	Perform transmission tests and check the telephone line's disengagement and re-engagement, as well as test results (eventually, with a code sensor simulator)	
		2.3.13	Inform the monitoring station of new signals generated by this system	
		2.3.14	Notify the clients and perform an actual alarm test, after the control panel is closed and the work is completed	
		2.3.15	Obtain information from the monitoring station about test results	
2.4	Program components, if applicable			
2.5	Turn the system on			
2.6	Check the system and its components			The security systems installer checks received signals. In the case of a surveillance camera, it is necessary to check pictures and, possibly, audio signals.
2.7	Clean the premises	Ibid 1.15		
2.8	Check the call list of the services and persons responsible	2.8.1	Check emergency service information and the list of responsible persons to be contacted, complete the information if necessary (using a standard form)	The security systems installer determines or confirms the emergency procedure with the clients.
		2.8.2	Communicate the information to the monitoring station and add it to the client file	

TASK 2 LINK SYSTEMS TO A MONITORING STATION

Operations	Sub-Operations	Clarifications
2.8 Check the call list of services and responsible persons (*cont'd*)	2.8.3 Inform the clients of the monitoring station control procedures; give them the client number, the monitoring station telephone number, etc. 2.8.4 Notify the monitoring station of the end of testing and the system's activation 2.8.5 Confirm to clients that their system is operational and linked to the monitoring station	
2.9 Train the clients	Ibid 1.17	
2.10 Update system plans	Ibid 1.18	
2.11 Report information about work done	Ibid 1.19	

TASK 3 INSPECT SYSTEMS

Operations	Sub-Operations	Clarifications
3.1 Plan the work	3.1.1 Take cognizance of the type of area 3.1.2 Take cognizance of the type of inspection and equipment, according to the contract 3.1.3 Take cognizance of the plan 3.1.4 Establish the type of report	
3.2 Notify the monitoring station and the concerned authorities of system tests	3.2.1 Put the system in place 3.2.2 Disconnect audio devices 3.2.3 Perform tests 3.2.4 Notify the authorities according to the regulation in effect	

TASK 3 INSPECT SYSTEMS

Operations		Sub-Operations		Clarifications
3.3	Check the good operation of components	3.3.1	Check possible changes to the physical environment	The good operation of components is checked according to the required protection and applicable standards: ULC, bank, municipal, industrial, etc.
		3.3.2	View the installation	
		3.3.3	Check the system's history	
		3.3.4	Check power sources	
		3.3.5	Follow manufacturer recommendations, if applicable	For this verification, the installer may perform a simulation of the device's alarm, for example.
				For example, changes in the environment may involve a wall that has been added, a tree that has grown, etc., after production of the original plan.
3.4	Test and confirm received signals with the concerned authorities	3.4.1	Check the various signals with the monitoring station (pictures, audio, alarm, etc.)	
		3.4.2	Check the various signals with each monitoring station	
		3.4.3	Reconnect and check audio devices	
3.5	Reactivate the system	3.5.1	Notify the monitoring station and the concerned authorities about the end of testing	
		3.5.2	Check call lists, if applicable	
3.6	Write the inspection report	3.6.1	Update the plans	The forms are pre-established. The installer fills them out manually or with a computer. He does not have to write complete texts. The reports require checking boxes or entering simple data.
		3.6.2	Fill out the required form	
		3.6.3	Sign required certificates	
				Security systems installers sign ULC or other certificates, depending on the company.

TASK 4 MODIFY SYSTEMS

Operations	Sub-Operations	Clarifications
4.1 Plan the work	4.1.1 Take cognizance of the contract, plans and specifications 4.1.2 Examine the site 4.1.3 Prepare one's equipment and tools 4.1.4 Do the electrical wiring diagram, indicating the quantity of required wires and the location of panels and junction boxes 4.1.5 Produce a schedule 4.1.6 Ensure that tools and special equipment (e.g.: scaffold, bucket truck, etc.) will be available when needed 4.1.7 Determine the location where wires or conduits are to pass 4.1.8 Classify required tasks by order of importance 4.1.9 Plan for the location of equipment 4.1.10 See if it is necessary to install surface raceways 4.1.11 Prepare the workplace (lay out one's equipment so as not to hinder ongoing operations) 4.1.12 Plan time for safety measures 4.1.13 Coordinate one's actions with those of other responders, if applicable	For sub-operation 4.1.12, see sub-operation 1.4.11 clarifications.
4.2 Notify the monitoring station and the concerned authorities about the system's testing	4.2.1 Put the system in place 4.2.2 Disconnect audio devices 4.2.3 Perform tests 4.2.4 Notify the authorities according to the regulation in effect	
4.3 Do the required alteration work	4.3.1 Evaluate the type of necessary cables or wires 4.3.2 Pierce the wall or obstacle to make cables and conduits pass through 4.3.3 Fasten the control panel 4.3.4 Install conduits and cables	The security systems installer may move and add components according to the work to be done. He may make physical or software changes.

TASK 4 MODIFY SYSTEMS

Operations	Sub-Operations	Clarifications
4.4 Check and program components, if applicable		
4.5 Notify the monitoring station and the concerned authorities about the changes made	4.5.1 Check the call list of services and responsible persons	
4.6 Clean the premises	Ibid 1.15	
4.7 Train the clients	Ibid 1.17	
4.8 Design or update system plans	Ibid 1.18	
4.9 Report information about work done	Ibid 1.19	

TASK 5 REPAIR AND SERVICE SYSTEMS

Operations	Sub-Operations	Clarifications
5.1 Notify the monitoring station and the concerned authorities about the system's testing		
5.2 Select necessary tools and equipment		This selection is made according to the type of system.
5.3 Disconnect audio alarms, if applicable		
5.4 Check the equipment and environment	5.4.1 Obtain comments from the clients 5.4.2 Check the system's history 5.4.3 Check eventual physical changes in the environment	This check is done visually and using measuring instruments. The main instruments used by the installer are a multimeter, glass break simulator, oscilloscope and decibelmeter.

TASK 5 REPAIR AND SERVICE SYSTEMS

Operations	Sub-Operations	Clarifications
5.5 Make a diagnosis		Depending on the scope of the diagnosed problem, the installer may: - proceed to a repair (if the problem is relatively simple and costs are low); - contact his employer to know the price and availability of certain parts; - check the clients' maintenance contract, if applicable; - contact the clients to inform them of the work to be done and the costs to plan for.
5.6 Perform repair or maintenance operations		The security systems installer cleans, greases and adjusts devices on a periodic basis, most often annually.
5.7 Check the system and its components with the monitoring station and the concerned authorities		
5.8 Reconnect sound signalling devices		
5.9 Use the sound signalling devices to check the entire system	5.9.1 Perform tests	
5.10 Reactivate the system with the monitoring station and the concerned authorities		
5.11 Clean the premises	Ibid 1.15	
5.12 Provide explanations to the clients about the work done		
5.13 Update system plans	Ibid 1.18	
5.14 Report information about work done	Ibid 1.19	

TASK 6 INTERACT WITH THE CLIENTS

Operations	Sub-Operations	Clarifications
6.1 Respond to service calls		This operation is not performed by all installers. It is assigned to them depending on a company's organization.
6.2 Plan meetings with the clients	6.2.1 Participate in a coordination meeting 6.2.2 Signal to the professional or the clients any divergence of codes and standards with the plans or the contract 6.2.3 Inform the clients of applicable terms and conditions	Divergences of codes and standards with what the contract provides for should be documented. Any other divergence detected later during work should also be reported. Applicable terms and conditions are related to the service rendered outside regular working hours (different rates, waiting periods, etc.).
6.3 Introduce oneself to the clients	6.3.1 Introduce oneself to the various persons at the workplace 6.3.2 Check with the clients whether the contract meets their requirements 6.3.3 Explain the work's progress to the clients 6.3.4 Check whether the location of equipment meets client requirements 6.3.5 Obtain information from the clients about eventual internal regulations 6.3.6 Invite the clients to move valuable items or fragile furniture	
6.4 Collect information from the clients		The clients describe their installation needs. When they require support, they tell the installer the type of problem, and he determines their needs.
6.5 Inform the clients of problems detected and work to be done		

TASK 6 INTERACT WITH THE CLIENTS

Operations	Sub-Operations	Clarifications
6.6 Estimate the cost of minor work		This operation is not always performed by security systems installers. Some installers estimate the cost of minor work, for example adding, modifying or moving components, replacing parts, etc.
6.7 Assist the vendor with a proposal	6.7.1 Estimate the time, parts and equipment required according to the work to be done	The installer assists the vendor and informs him in the case of a proposal related to a complex installation and when: - the level of difficulty is high; - specific standards are to be met; - a site is very extensive, with several buildings, pavilions or large buildings; - etc. With his expertise, the installer provides a level of detail that the vendor cannot have. At times, he also accompanies the vendor to check the compatibility of devices, for example when a new product version arrives on the market.
6.8 Provide a technical assessment of problematic events		Events that may occur are, for example, a fire, theft, etc. This operation consists of the installer investigating whether the security system was not triggered, and understanding whether the fault is the client's (who may simply have omitted to arm the system) or the security company's. The operation also serves to collect evidence in case the security company is sued. This operation also serves, for example, to evaluate damaged components.
6.9 Confirm the work done to the clients		The security systems installer presents the work order to the clients, to confirm the work done.

2.3 ACHIEVEMENT CONDITIONS

Achievement condition data were collected for the entire trade of security systems installer. They pertain to aspects such as workplaces, health and safety hazards, reference work and material resources used.

Table 2.3 Achievement Conditions

ACHIEVEMENT CONDITIONS
Workplaces[28] Security systems installers work indoors and outdoors, in every Quebec region. They respond wherever there is a security need regarding persons, buildings or goods. They work in various types of buildings, such as: hospitals, plants, offices, high-rises, pharmaceutical companies, mining companies, educational institutions, etc. Occasionally, the security systems installer is called upon to work in locations difficult to access, such as narrow passages, subfloors, etc., or, very rarely, in enclosed spaces[29].
Instructions Security systems installers work according to instructions, in the form of service calls, work orders and inspection lists. These instructions may be given in person, by telephone, e-mail, mobile operating system (Pocket PC), etc.
References Installation manuals, manufacturer data sheets, programming sheets, product and system instruction manuals, fire standard specifications and ULC standard specifications are the main documents used by security systems installers. Some of these reference documents may be consulted in electronic format, and others in paper format.
Raw materials, tools and equipment Annex 1 of the present report contains a list of material resources used by security systems installers in practising their specialty. Under collective agreements, certain tools are provided by the security systems installer and others by his employer.

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28. Non-exhaustive list.
29. Work in enclosed spaces may require a permit.

ACHIEVEMENT CONDITIONS
Health and safety hazards Annex 2 of the present report contains a list of the main hazards related to the tasks and operations of the security systems installer specialty, as well as a list of applicable preventive measures.
Level of autonomy The security systems installer generally works alone. Occasionally, depending on the scope of the project, he is accompanied by another security systems installer. He may also work with a worker from another trade. In some types of establishments (banks, certain types of companies), the installer may be escorted by a security guard. The installer is autonomous in doing his work. Generally, his supervisor (or the project leader) inspects his work on-site only in special cases or after receiving a complaint.
Stress factors The work involves stress factors related, among other things: • to time management in view of deadlines; • to the unknown, with the arrival of new products (rapid technological evolution); • to client requirements or requests; • to complex problems to solve.
Decision-making A workshop participant mentioned: "I feel like a self-employed worker." The security systems installer makes decisions related to work organization, work priorities, support to provide, etc. One expert added: "It's a brush fire, it moves constantly." The security systems installer's decisions have an impact on work quality, the security of persons, goods or buildings, etc. In cases where the impact may be major, he will call upon his supervisor to make a decision.

2.4 PERFORMANCE CRITERIA

Performance criteria were collected for each task. They are used for evaluating whether tasks have been performed satisfactorily. The criteria apply to aspects such as the quantity and quality of the work done, observance of a work procedure, the attitudes adopted, etc.

To draw a list of criteria related to each task, the participants worked in teams of two or three. Their results were then collected and presented in full session. So some criteria may apply at times to other tasks as well as to those for which they were selected.

Table 2.4   Performance Criteria

TASK 1   INSTALL SYSTEMS

Performance Criteria
- Following the operational procedure. - Adequate preparation of tools. - Complete equipment. - Overall understanding of the project. - Good communication with the various stakeholders. - Well secured and aesthetic raceways and cables. - Components fastened according to manufacturer standards. - Verifying the firmness of connections. - Aesthetic visual aspect of the components and panel.

TASK 2   Link Systems to a Monitoring Station

Performance Criteria
- Sound examination of the network. - Sound analysis of the difficulty presented by the premises. - Correct verification of connections. - Adequate verification of panel type and compatibility. - Sound interpretation of the programming book. - Aesthetic visual aspect of the panel. - Good operation of the systems. - Quick execution of the work. - Observance of priorities and installation standards. - Choosing the correct codes (activation, programming, commissioning). - Meticulousness. - No confusion between civic and electronic addresses. - Good programming. - Appropriate verification of the work before performing tests. - Correct connections. - Well-installed components. - System functionality. - Consistent quality of work. - Clean premises. - Paying close attention to clients and their needs. - Clear and accurate explanations to clients. - Making sure others understand. - Communicating relevant information to clients.

TASK 3   INSPECT SYSTEMS

Performance Criteria
- Sound understanding of the systems. - Quick evaluation of the steps to be taken. - Ability to synthesize. - Precise verbal and electronic testing. - Meeting standards. - Rigorous testing of all components. - Accurate reports. - Well-completed documents. - Document cleanliness.

TASK 4   ALTER SYSTEMS

Performance Criteria
- Correct recognition of products. - Correct application of work methods. - Autonomy and initiative. - Diplomacy. - Neat personal appearance. - Professionalism. - Meeting standards. - Meeting client expectations. - Dexterity. - Attention to detail. - Good working order of the modified system. - Adequate application of security measures. - Cleanliness of the premises.

TASK 5   REPAIR SYSTEMS AND SERVICE THEM

Performance Criteria
- Good presentation. - Politeness toward the clients. - Listening attentively to the clients' various problems. - Facing the unknown with calm. - No jumping to conclusions on the various problems. - Correct analysis of data provided by the clients. - Appropriate search for the origin of problems. - Crosschecking client data with panel or monitoring station events. - Adequate repair or replacement of any defective parts. - Simulation of analysis data. - Careful testing with the concerned authorities and the monitoring station. - Correct explanation, with simple terms, of the cause of problems. - Detailed description of work done, on the work order.

Performance Criteria
- Diplomacy with the clients. - Ability to reassure the clients. - Tolerance and adaptation to various types of clients. - Accurate information provided to the clients. - Capacity to decode and interpret the clients' remarks. - Listening attentively to the clients. - Positive attitude. - Neat attire. - Professionalism. - Discretion. - Confidentiality regarding services offered to the clients. - Ethical behaviour toward the clients, their company and the competition.

2.5 FUNCTIONS

Functions correspond to a set of related tasks. This set may be defined by the work's results or by a sequence of steps.

For the security systems installer specialty, the participants agreed with the two functions presented below. Thus, the security systems installer's work includes:

- An **installation** function grouping the following tasks:

  1. *Install systems*[30]
  2. Link systems with a monitoring station
  4. Modify systems[31]
  6. Interact with the clients

- A **service** function grouping the following tasks:

  2. Link systems with a monitoring station
  3. *Inspect systems*
  4. Modify systems
  5. *Repair and service systems*
  6. Interact with the clients

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30. Tasks written in italics are exclusive to one function or another.
31. Depending on company organization or the work, the tasks *in italic* are performed during installation or servicing.

3. QUANTITATIVE DATA ON TASKS

3.1 OCCURRENCE

Occurrence data concern the percentage of security systems installers[32] who perform a task in the same workplace. The data presented in the tables below are averages of the 12 participants in the workshop. However, they describe the time allocation not only of the security systems installers present at the workshop, but also of the security systems installers who work in the companies represented.

Table 3.1 Occurrence of Tasks

Task	Occurrence
1. Install systems	73%
2. Link systems to a monitoring station	78%
3. Inspect systems	66%
4. Modify systems	91%
5. Repair and service systems	71%
6. Interact with the clients	100%

3.2 WORK TIME

Work time, also expressed as a percentage, represents the average time allocated to each task on a **weekly** basis by the participants consulted.

Table 3.2 Allocation of Work Time to Each Task

Task	Work Time
1. Install systems	34%
2. Link systems to a monitoring station	5%
3. Inspect systems	9%
4. Modify systems	10%
5. Repair and service systems	34%
6. Interact with the clients	8%
	100%

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32. The data also include apprentices.

We note that Task 1/install systems and Task 5/repair and service systems take up the largest percentage of the participants' work time; each takes up 34%. The participants allocate on average 8% of their work time to Task 6/interact with the clients.

Moreover, in examining individual results, we observe that three of the participants never perform Task 1/install systems, since they work in companies that provide service exclusively, and not installation. In addition, two of the participants who work for companies specializing in installation never perform Task 2/inspect systems.

3.3   IMPORTANCE AND DIFFICULTY OF THE TASKS

The **importance** of a task is estimated according to the more or less harmful consequences of performing a task poorly or not at all. The importance is assessed according to the following scale:

1.Not important:	Performing the task less successfully does not lead to consequences for the result's quality, the costs, health and safety, etc.;
2. Not very important:	Poor execution of the task may entail minimal costs, lead to an unsatisfactory result or involve risks of injury, minor accidents, etc.;
3. Important:	Poor execution of the task may entail substantial additional costs, injuries, accidents, etc.;
4. Very important:	Poor execution of the task may entail very major consequences regarding costs, safety, etc.

A task's **difficulty** is assessed according to the following scale:

1. Very easy:	The task involves little risk of error; it requires no notable physical or mental effort. Performing the task is less difficult than average;
2. Easy:	The task involves a few risks of error; it requires minimal physical or mental effort;
3. Difficult:	The task involves many risks of error; it requires a good physical or mental effort. Performing the task is more difficult than average;
4. Very difficult:	The task involves a high risk of error; it requires substantial physical or mental effort. The task is among the most difficult in the trade.

The data presented in the table below are the average results of the security systems installers who participated in the workshop.

Table 3.3 Importance and Difficulty of Tasks

Task	Importance	Difficulty
1. Install systems	3,9	2,8
2. Link systems to a monitoring station	3,8	2,3
3. Inspect systems	3,7	2,0
4. Modify systems	3,8	2,6
5. Repair and service systems	3,8	2,7
6. Interact with the clients	3,8	1,9

4. KNOWLEDGE, SKILLS AND ATTITUDES

The occupational analysis has identified a number of knowledge areas, skills and attitudes necessary to performing the tasks, and transferable by being applicable to a variety of tasks and situations.

In the following pages we present the knowledge areas, skills and attitudes that the participants consider essential for performing the tasks of the trade of the security systems installer specialty.

4.1 KNOWLEDGE

Mathematics

Security systems installers perform the four basic mathematical operations while doing their work. The binary, hexadecimal and decimal numeration systems are used.

Computers and networking

Security systems installers must have a knowledge of computer components and peripherals, the main operating systems, network configuration, and communications protocols. This knowledge enables them, for example, to configure devices, install software and components, troubleshoot network failures, etc.

Installers use a notebook computer for easy data entry. They navigate the Internet in order, for example, to consult sites related to the products they install.

Construction

Basic concepts regarding residential, commercial and industrial building structures are useful to security systems installers. Knowledge of building code standards and of certain locksmithing concepts are necessary to the work of security systems installers.

Electricity and electronics

Security systems installers must have a basic knowledge of electricity and electronics that pertains, among other things, to:

- electrical symbols (diagram interpretation);

- resistance colour codes;

- electrical system components (transformer, circuit breaker, types of cabling, etc.);

- electronic system components (light emitting diodes [DEL] or others, wafers, etc.);

- measuring units: volt, watt, hertz and ampere;

- Ohm's law;

- electric current intensity, alternating current intensity, alternating current and direct current circuits;

- reading plans and specifications (symbols, icons, etc.);

- using test equipment (oscilloscope, decibelmeter, etc.).

Means of telecommunications

The participants mentioned that knowledge of the following means is necessary: GSM (global system for mobile communications[33]), CDMA (code division multiple access[34]), IP networking, EV-DO (Evolution Data Optimized[35]), radio, etc.

Languages and communication

Knowledge of basic principles of interpersonal communication is necessary in doing the work. Security systems installers must:

- establish good relations with the clients;

- express themselves clearly, in order to adequately explain the work to be done, and in order to train the clients;

- be good listeners when interacting with the clients, colleagues and other persons concerned;

- explain technical information in everyday language.

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33. Standardized mobile telephone system.
34. American technology used for the cellular network.
35. High-speed wireless network.

In addition, knowledge of English is essential. The installer may have to write in English when e-mailing a request for technical support, responding to a service call, or communicating with technical personnel or anglophone clients. He also has to speak English when, for example, communicating with the technical assistance service of system providers (often located in the United States or Ontario). Given that most reference documents are in English, the installer must be able to read technical English. He may also have to take specialized training outside Quebec.

Laws and regulations

Security systems installers must know:

- the standards prescribed by product manufacturers (according to product characteristics);
- the building code, as well as the laws and standards presented in section 1.5 of the present report.

Occupational health and safety

Knowledge and application of occupational health and safety rules is essential. Security systems installers must behave safely throughout their work. Annex 2 presents a grid of occupational health and safety aspects that pertains to the tasks and operations of installers.

4.2 SKILLS

Skills mean know-how. They are divided into three categories: cognitive, motor and perceptual.

Cognitive skills

Cognitive skills involve intellectual strategies used for working. The main cognitive skills necessary to security systems installers are the following:

- analytical ability, to make diagnoses;
- thinking ability;
- problem-resolution;
- logic.

Motor skills

Motor skills involve gestures and movements. The main motor skills necessary to security systems installers are the following:

- good physical ability and strength;

- good physical coordination (for example, to move ladders);

- dexterity;

- fine grasp.

Perceptual skills

Perceptual skills are sensory skills enabling a person to perceive by his senses what is happening in his environment. The main perceptual skills necessary to security systems installers are the following:

- visual acuity (poorly lighted areas, small objects);

- capacity to distinguish colours (not being colour blind);

- capacity to detect noises (for example, beeps and other electric and electronic noises);

- sense of observation (to examine the premises and troubleshoot problems).

4.3   ATTITUDES

Attitudes are a way of acting, reacting and relating with others or with one's environment. They involve personal skills. The main attitudes necessary to security systems installers are the following:

- capacity to remain calm;

- capacity to manage stress;

- diplomacy;

- availability;

- teamwork;

- dedication to work;

- integrity;

- willing to work on a variety of projects;

- politeness toward the clients;

- professionalism;

- observance of confidentiality.

5. TRAINING SUGGESTIONS

The participants in the workshop made suggestions about the various aspects of training. Those suggestions are:

Initial training

- Have students benefit from touring a construction site.

- Develop learning strategies that correspond to the reality of the work: regarding electricity, include the alarm system and recreate real situations; assemble and install an actual computer network; configure and integrate systems.

- Focus training on approaching the client and presenting oneself. Client service is essential to the company's image.

- Reduce the time allocated to theory and increase the hours of practice, which will enable the student to improve and better develop his skills, for example regarding access systems.

- Reduce the duration of training in plans and specifications.

- Increase necessary budgets for using up-to-date materials and equipment.

- Introduce more concepts regarding home automation and logic circuits.

- Plan for teaching about installation before teaching about service, because the former is essential to understanding service.

- Make stages accessible regarding residential sector installations.

- Focus the stages on installation rather than service.

Further training and development

- Provide training in computers, new technologies, differences between IP camera brands (Sony, Panasonic, Bosch, Axis, Pelco, etc.), and access control, fire alarm and antitheft systems.

- Organize training that is specific and exclusive to the specialty of security systems installers. In the participants' experience, training sessions offered jointly to electricians and installers prove less than satisfactory[36].

- Assign a trainer who can visit company premises to provide training.

- Improve the dissemination of information about the training offer. Issue reminders or send follow-up e-mail to security systems installers (course dates, cancellations, postponements, etc.).

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36. Since electricians are much more numerous, the trainers must first take into account their level of knowledge and needs, which are completely different from those of installers, particularly regarding computers, new technologies, etc.

ANNEXES

During the occupational analysis workshop, the participants were presented a list of equipment, tools and instruments from the 1999 work situation analysis [37] and were asked to adapt the list to each task of the trade. Accordingly, the participants added, corrected and withdrew items from the list, depending on the work to be done. The information gathered from this exercise is presented in the tables below.

Table A.1 Equipment, Tools and Instrumentation

Task 1	Install Systems

Tools and Equipment

- Stapler
- Boots
- Hard hat
- Wood chisel
- Allen key (imperial and metric)
- Pipe wrench, adjustable wrench
- Ratchet wrench
- Nylon cord
- Knives, gyproc knife
- Knock-out punch
- Stepladder, ladder and scaffold
- Soldering iron
- Gloves and safety glasses
- Flashlight
- Hammer
- Drill bits (wood, concrete, steel)
- Boom lift
- Level
- Drill (percussion or simple, wireless)
- Pliers, crimping pliers
- Wire and coaxial cable strippers
- Fastening gun
- Pipe bender
- Wire punch (*bixer*)
- Extension cord
- Grinder
- Measuring tape
- Fish tape (this tool is used for passing wires through already-installed conducts, or through walls or ceilings of existing buildings)
- Reciprocating saw, hacksaw, two-handed saw
- Screwdriver (flat tip, cross tip, No. 4, 6, 8 and 10)
- Tamperproof screwdriver for tamperproof screws

Instruments

- Cable identifier
- Impedance bridge
- Decibel and hertz measuring instrument
- Verification loudspeaker
- Service monitor
- Multimeter
- Notebook computer
- Oscilloscope
- Line simulator, glass break simulator
- Verification telephone
- Wire finder

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37. Ministère de l'Éducation, *Spécialiste de systèmes de sécurité : rapport d'analyse de la situation de travail*, Québec, 1999.

Equipment and Products (all equipment must be ULC listed)

- Anchors
- Filler
- Bolts
- Assorted cables according to installation type
- Components matching system types
- Conduits and accessories
- Connectors of assorted cables
- Software matching the installed system, if applicable
- Wire connectors
- Control panel
- Resistors
- Electric tape, insulating tape
- Fire-retardant sealant
- Silicone
- Screws

Task 2   Link a System to a Monitoring station

Tools

- Stapler
- Hard hat
- Gloves
- Stepladder
- Flashlight
- Safety glasses
- Drill
- Wire stripper
- Combination pliers
- RS-12 pliers and RJ-45 pliers
- Screwdriver
- Fish tape

Instruments

- Multimeter
- Notebook computer
- Oscilloscope
- Line simulator (digital or DVACS)
- Verification telephone

Equipment and Products

- Anchors and various fasteners
- Housing
- Cables
- Wires
- Software
- Telephone jack (CA38-A)

Task 3   Inspect Systems

Tools and Equipment

- Ladder
- Stepladder
- Safety equipment
- Flashlight
- Various pliers
- Measuring tape
- Screwdriver

Task 3　Inspect Systems

Instruments

- Monitor
- Multimeter
- Notebook computer
- Glass break simulator
- Verification telephone

Equipment and Products

- Detectors of all types (smoke, heat, motion, contact)
- Scanners
- Aerosol smoke
- Lubricant
- Batteries

Task 4　Modify Systems

Tools and Equipment

- Stapler
- Boots
- Hard hat
- Wood chisel
- Allen key (imperial, metric)
- Pipe wrench, adjustable wrench
- Ratchet wrench
- Nylon cord
- Knives, gyproc knife
- Cookie cutter
- Stepladder, Ladder and scaffolding
- Soldering iron
- Gloves and safety glasses
- Flashlight
- Knife
- Drill bits (wood, concrete, steel)
- Boom lift
- Level
- Grommet
- Drill (percussion or simple, wireless)
- Pliers, crimping pliers, wire stripper and coaxial cables
- Fastening gun
- Pipe bender
- Extension cord
- Grinder
- Wire punch (bixer)
- Measuring tape
- Fish tape (this tool is used for passing wires through already-installed conducts, or through walls or ceilings of existing buildings)
- Reciprocating saw, hacksaw, two-handed saw
- Screwdriver (flat tip, cross tip, No. 4, 6, 8 and 10)
- Tamperproof screwdriver for tamperproof screws

Instruments

- Cable identifier
- Impedance bridge
- Decibel and hertz measuring instrument
- Verification loudspeaker
- Service monitor
- Multimeter
- Notebook computer
- Oscilloscope
- Line simulator, glass break simulator
- Verification telephone
- Wire finder

Equipment and Products (all equipment must be ULC listed)

- Anchors
- Filler
- Bolts
- Assorted cables according to installation type
- Computer components matching system types
- Conduits and accessories
- Connectors of assorted cables
- Software matching the installed system, if applicable

- Wire connectors
- Control panel
- Resistors
- Electric tape, insulating tape
- Fire-retardant sealant
- Silicone
- Screws

Task 5　　Repair and Service Systems

Tools and Equipment

- Stapler
- Attaches de nylon
- Allen key (metric, imperial)
- Ratchet wrench (multi-socket (metric and imperial) kit)
- Ladders (20 ft. and 24 ft.)
- Stepladders (4 ft. and 8 ft.)
- Soldering iron

- Drill bits (wood, steel, concrete)
- Percussion drill (battery powered)
- RG-59, RG-6 crimping pliers
- Crimping pliers, cat. 5
- Fish tape
- Screwdriver

Instruments

- Frequency analyzer (spectrum analyzer)
- Viewing monitor
- Multimeter
- Notebook computer

- Glass break simulator
- Verification telephone
- Wire finder
- Wire-measuring instrument kit: 4/22, 8/22, and 2/18, 6/22 overhead, class 5, RG 59, RG 6, RJ 45, etc.

Equipment

- Anchors
- Housing
- Bell
- Detectors of all types (smoke, heat, motion, contact)

- Cables for connecting to various devices
- Empty sheaths
- Software
- Control panel
- 30 W siren and 15 W siren and piezo

Task 6　　Interact with the Clients

Other than necessary equipment for communicating with the clients (telephone, e-mail, etc.), the installer uses no specific equipment, instrument or material for this task.

Occupational Health and Safety Grid

Prepared by: **Gaston Dufour, Inspector**
Commission de la santé et de la sécurité du travail

Occupational Health and Safety

1. Working from Heights

Using stepladders and scaffolds, scissor lifts and boom lifts can pose fall hazards that can lead to fractures, paralysis and even death. Appropriate maintenance of equipment and a knowledge of work techniques are therefore necessary. When working from heights, the installation of a parapet in compliance section 3.8 of the Safety Code for the construction industry must be considered as the primary solution. When the height exceeds 3 metres, wearing a safety harness is required as a means of personal protective equipment.

Working in enclosed spaces:

During work in enclosed spaces, section 3.21 of the Safety Code for the construction industry must be applied in its entirety. The principal contractor must determine the procedure for ensuring worker safety.

2. Incorrect Use of a Manual Tool or a Portable Power Tool

Using equipment, instruments and tools (drills, screwdriver, knives, pliers) can pose hazards of various injuries, such as burns, bruises or cuts. Some injuries may be serious, and even necessitate an amputation. Appropriate maintenance of equipment and a knowledge of work techniques are therefore necessary, and wearing safety glasses and gloves is required as a means of personal protective equipment.

3. Working on Energized Devices

Electrocutions are frequent and can cause death in certain cases. The observance of CSST safety regulations and a knowledge of work techniques are therefore necessary (for example, workers must ensure that a lockout method is put in place and that any energy source is deactivated during work). In addition, equipment, instruments and tools such as electric drills and saws must be maintained regularly.

4. Lifting Heavy Loads and Manoeuvring Large Devices

Using heavy equipment (cable roller, stepladder, ladder, control panel, etc.) can pose health hazards, which mainly result in back injuries. Adopting appropriate working postures, working in a team or using equipment for lifting or transporting various heavy components (cart, handtruck, etc.) are effective means of preventing such incidents.

5. Noise

Using equipment, instruments and tools (drill, reciprocating saw, fastening gun, siren) exposes the worker to elevated noise levels that can affect hearing. To protect the auditory system, the use of less-noisy equipment, instruments or tools, and of personal protective equipment (shells, ear plugs), should be considered during various tasks.

6. Hazardous Environment

- Working in a plant containing toxic substances, flammable products, explosives, etc.

When working on a company's premises, workers may be exposed to various sources of danger (chemicals, noise, gases, enclosed spaces), depending on the workplace. Workers should be informed about the hazards to which they are exposed and, if necessary, they should receive training before doing the work. In addition, they must observe the safety rules prescribed by the company receiving their services.

- Presence of materials containing asbestos

Materials containing asbestos (plaster, stucco, mechanical insulation, limpet spraying, etc.) may be present in residential, commercial or industrial buildings constructed before 1980. If removal, drilling, sawing or other work is planned, section 3.23 of the Safety Code for the construction industry must be applied in its entirety. To protect themselves, workers must be capable of determining the various materials likely to contain asbestos and must inform their supervisor, before work begins.

Table A.2 Description of Sources of Danger

	Sources of Danger	Effects on Health and Safety	Means of Prevention and Protection
1	**a) Working from Heights** - Stepladder - Ladder - Scaffolding - Lifting device	• Fall • Load drop	• Using safe temporary means of access. • Wearing a safety harness with a shock absorber. • Using a parapet. • Using a ladder for work of short duration (less than one hour) and applying section 3.5.6 of the Safety Code for the construction industry. • Using a stepladder meeting the CAN3-Z11-M81 standard. (See the Safety Code for the construction industry, section 3.5.7.) • Organizing the work so as to eliminate superimposed work.
	b) Working in enclosed spaces	• Intoxication, suffocation • Deflagration	• Applying a safe work method. (See the Safety Code for the construction industry, section 3.21.) • Ensuring exhaust ventilation. • Having a respirator.
2	**Incorrect use of a manual tool or a portable power tool**	• Bruise • Joint injury • Face and eye injury • Burn • Noise	• Using, maintaining and repairing tools according to manufacturer specifications. • Wearing personal protective equipment for the eyes, limbs and ears. (See the Safety Code for the construction industry, section 2.10.)
3	**Working on energized devices**	• Electric arc, electrocution, electrification • Face and eye injury	• Putting a lockout method in place. • Using an electric extension cord in good condition. • Using insulated tools and accessories. (See the Safety Code for the construction industry, section 2.11.)

	Sources of Danger	Effects on Health and Safety	Means of Prevention and Protection
4	**Lifting heavy loads and manoeuvring large devices**	• Load drop • Bruise, limb injury • Intense effort	• Using a lifting device. • Having been trained in applying a safe lifting method. • Not moving under a load.
5	**Noise**	• Deafness	• Using auditory protection (shells, ear plugs). • Using less-noisy tools. • Moving away from the noise source, if possible.
6	**Hazardous environment** a) Working in a plant containing toxic substances, flammable products, explosives, etc.	• Intoxication • Burn • Explosion • Fire	• Adopting work means and methods according to the establishment's safety guidelines. • Wearing personal protective equipment, depending on the workplace and risk.
	b) Presence of materials containing asbestos	• Lung disease	• Having been trained to determine materials likely to contain asbestos. • Ensuring that materials containing asbestos are removed from the various locations where work is to be done. The work must meet section 3.23 of the Safety Code for the construction industry.
7	**Extreme temperature or humidity**	• Burn, chilblain • Heatstroke	• Wearing appropriate work clothing. • Alternating the work according to thermal conditions.
8	**Driving a Vehicle**	• Traffic accident	• Ensuring that the vehicle is in good condition. • Knowing preventive driving methods (snow, rain, heavy traffic).

Table A.3 Sources of Danger per Task and Operation

Tasks and Operations	Working from Heights and in Enclosed Spaces	Incorrect Use of a Manual Tool or a Portable Power Tool	Working on Energized Devices	Lifting Heavy Loads and Manoeuvring Large Devices	Noise	Hazardous Environment	Driving a Vehicle
1. Install systems							
1.1 Examine the work to be done							When ever travelling
1.2 Prepare one's equipment and tools				X			When ever travelling
1.3 Examine the site	X					X	When ever travelling
1.4 Plan the work							When ever travelling
1.5 Install cables with raceways	X	X	X	X	X	X	When ever travelling
1.6 Install cables without raceways	X	X	X	X	X	X	When ever travelling
1.7 Assemble and install the main panel	X	X		X	X	X	When ever travelling
1.8 Install peripheral components	X	X	X	X	X		When ever travelling
1.9 Make the connections	X	X		X	X	X	When ever travelling
1.10 Program components, if applicable							When ever travelling
1.11 Turn the system on	X		X			X	When ever travelling
1.12 Check the system and its components	X	X	X		X		When ever travelling
1.13 Integrate systems, if applicable			X				When ever travelling
1.14 Test the system with the monitoring station and the concerned authorities, if applicable							When ever travelling
1.15 Clean the premises						X	When ever travelling
1.16 Provide a certificate, if applicable							When ever travelling
1.17 Train the clients							When ever travelling
1.18 Design or update system plans							When ever travelling

Tasks and Operations	Working from Heights and in Enclosed Spaces	Incorrect Use of a Manual Tool or a Portable Power Tool	Working on Energized Devices	Lifting Heavy Loads and Manoeuvring Large Devices	Noise	Hazardous Environment	Driving a Vehicle
2. Link systems to a monitoring station							
2.1 Plan the work							
2.2 Make the necessary connections	X	X					
2.3 Activate the communications network							
2.4 Program components, if applicable							
2.5 Start up							When ever travel- ling.
2.6 Check the system and its components	X						
2.7 Clean the premises						X	
2.8 Check the call list of the services and persons responsible							
2.9 Train the clients							
2.10 Modify the plans							
2.11 Report on the work done							
3. Inspect systems							
3.1 Plan the work							
3.2 Notify the monitoring station and the concerned authorities of system tests							When ever travel- ling.
3.3 Check the good working order of components	X		X		X	X	
3.4 Test and confirm received signals with the concerned authorities							
3.5 Reactivate the system							
3.6 Write the inspection report							

Tasks and Operations	Working from Heights and in Enclosed Spaces	Incorrect Use of a Manual Tool or a Portable Power Tool	Working on Energized Devices	Lifting Heavy Loads and Manoeuvring Large Devices	Noise	Hazardous Environment	Driving a Vehicle
4. Modify systems							
4.1 Plan the work						X	
4.2 Notify the monitoring station and the concerned authorities of system tests	X						
4.3 Perform required alterations	X	X		X	X	X	
4.4 Check and program components, if applicable							When ever travel-ling.
4.5 Notify the monitoring station and the concerned authorities of the changes made							
4.6 Clean the premises						X	
4.7 Train the clients							
4.8 Design or update system plans							
4.9 Report on the work done							
5. Repair and service systems							
5.1 Notify the monitoring station and the concerned authorities of system tests							
5.2 Select necessary tools and equipment							
5.3 Disconnect audio alarms, if applicable	X						
5.4 Check the equipment and the environment							When ever travel-ling.
5.5 Make a diagnosis							
5.6 Perform repair or maintenance operations	X	X	X		X		
5.7 Check the system and its components with the monitoring station and the concerned authorities							
5.8 Reconnect audio alarms	X						

Tasks and Operations	Working from Heights and in Enclosed Spaces	Incorrect Use of a Manual Tool or a Portable Power Tool	Working on Energized Devices	Lifting Heavy Loads and Manoeuvring Large Devices	Noise	Hazardous Environment	Driving a Vehicle
5.9 Check the entire system with the monitoring station and concerned authorities							
5.10 Reactivate the system with the monitoring station and the concerned authorities							When ever travel-ling.
5.11 Clean the premises						X	
5.12 Explain the work done to the clients							
5.13 Update system plans							
6. Interact with the clients							
6.1 Respond to service calls							
6.2 Plan meetings with the clients							
6.3 Introduce oneself to the clients							
6.4 Collect information from the clients							
6.5 Inform the clients of the problems detected and the work to be done							When ever travel-ling.
6.6 Estimate the cost of minor work							
6.7 Assist the vendor with his proposal							
6.8 Provide a technical assessment of problematic events							
6.9 Confirm the work done to the clients							

Approval of the Electrician Professional Subcommittee

The occupational analysis report titled *Security Systems Installer* was tabled and discussed at the Electrician Professional Subcommittee, during its meeting of November 16, 2009.

The subcommittee members favourably received the report and recognized its quality. They also specified, regarding Section 5, "*Training Suggestions*", the importance of professional development training in computers and IP technologies. They added that client service should be a more prevalent theme in the training dispensed.