SONY 顾问公司培训教材

THE SONY´S WAY TAINING MATERAL

(三)

《建立標准時間》

《Establishment Of Standard Time》

VTECH 偉易達電子產品有限公司

編號： FI - XXX　　編輯： 王緒棟

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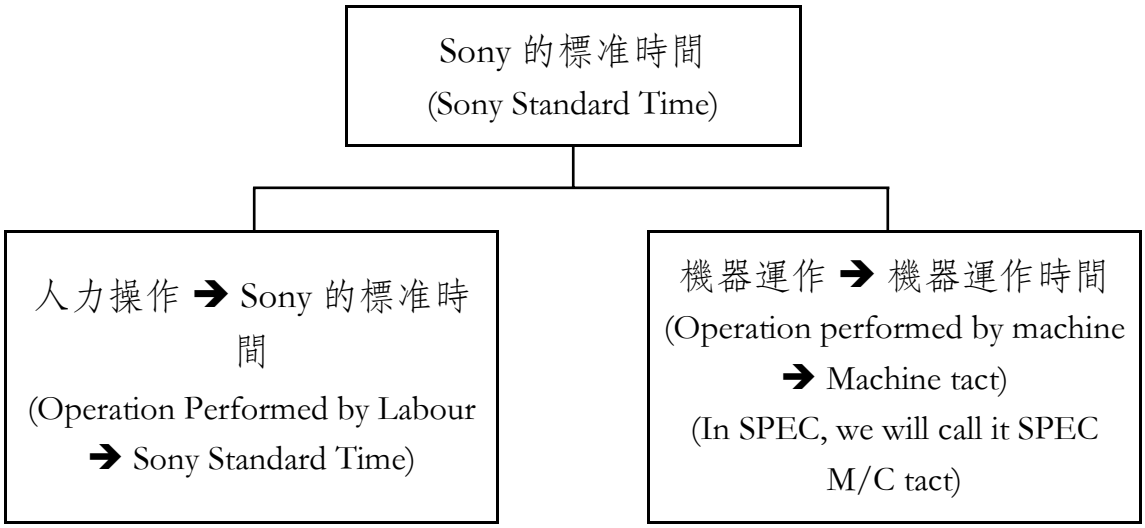
第一節：背景(BACKGROUND)

Sony 的標准時間 (Sony Standard Time)



1. **Sony 的標准時間 - 人力操作時間 {Sony Standard Time (SST) - Labour operation}**

   1) 通常意義下的 ST (ST in general context)

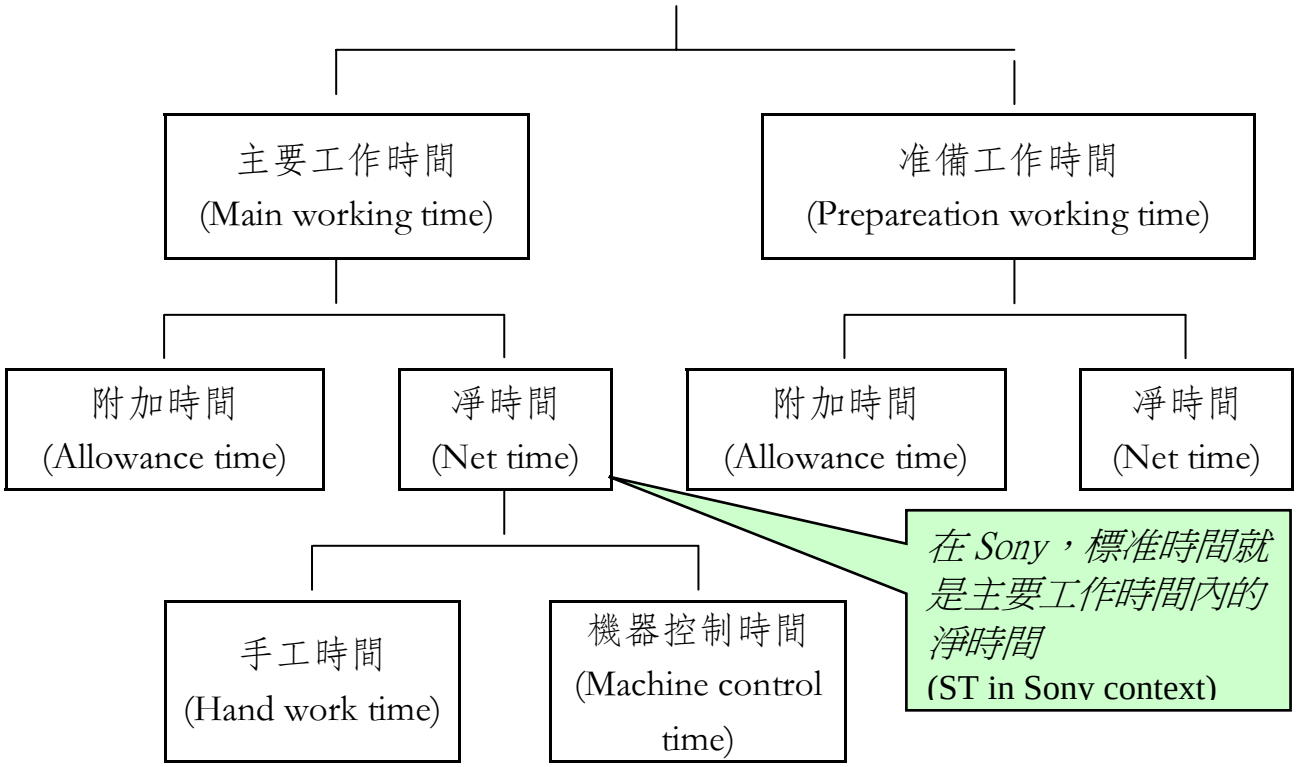
      a. ST 是 Standard Time 的縮寫 (ST stands for Standard Time)。

      b. 一個操作的標准時間就是執行這個操作所需要的時間 (Standard time of an operation is the time required to performthat operation)。

      c. 標准時間的作用 (ST is useful in)：

         - 時間及人力資源計划 (Planning: time and manpower)。
         - 成本預算 (Cost estimation)。
         - 績效評估 (Performance measurement)。
         - 信心 (Operation decision making)。

通常的標准時間
(ST in general context)



2) 標准時間的定義 (Definition of ST)

- 標准時間(ST)是指一個熟練的操作者在适宜的工作環境下，以正常的操作速度，按照既定的合理操作方法，完成一個符合品質要求的產品所需的最短時間 (If a skillful operator is working under normal operating conditions, and he is making reasonable effort, following the prescribed methods and specified quality standard, then Standard Time(ST) is that amount of time required to perform and operation in the shortest possible time)。
  - 熟練程度：中上水平操作者，了解流程，懂得机器操作或工具的使用，做某項工作達到每周 1500 次以上 (Skillful: average experience opr, who understands the procedure and the operation of the M/C or tool required.Normally, after doing it for 1,500 times / wk)。
  - 勞動強度：工作允許的范圍 (Reasonable effort: Concentrating in her job)。
  - 正常操作條件：生產設計應保証工人不要在引起疲勞的情況下工作。如：女工搬運重量不超過 4.5 公斤 (Normal operating condition: Production engineer should ensure that operator is not working under condition that will cause fatigue. E.g.: No ladies operators should carry weight of more than 4.5kg for a 8 hrs work)。

- 規定方法：操作標准 (Prescribed method: Operation standard)。
- 指定質量標准：通過工位自檢和生產線 QC 檢查 (Specified quality standard: Pass In-process inspection and line QC inspection)。
- 最短操作時間 (Shortest possible time)。

3) 什么是理論標准時間 (What is HQ ST)?

a. 理論標准時間是一個操作者用標准生產方式和最有效的方法去進行操作的所需的最短操作時間 (HQ ST is the shortest possible time required for an operator to perform an operation in the most efficient manner and with the standard production system)。

b. 標准生產方式是在已确定好的方法中最有效的生產方式 (Standard production system is the most efficient production system among the well established method)。

- 如果一個工厂采用 CAST 涂膠機涂膠超過 50%的比率，那么 CAST 就是确定的好方法 (If more than 50% of the plants are using CAST m/c for adhesive application, then CAST is the well established method)。
- 進一步講，如果 A 公司用 10 秒鐘去在 4 個地方涂膠水，而 B 公司只用了 9 秒鐘，那么理論標准時間就是 9 秒 (Further more, if company A took 10 sec to apply adhesive at 4 allocaions & company B took 9 sec to apply adhesive a the same 4 points, then HQ SST is 9 sec)。

c. 理論標准時間也被稱為標准淨時間或簡稱 ST (HQ ST is also called Standard Net Time or simply ST)。

d. 新 Model 的理論標准時間就是設計者實際采用的方法的標准時間 (HQ ST for new model is actually the designer method ST)。

4) 理論標准時間的范圍(Scope of HQ ST)

- 理論標准時間适用於每一种產品。這些產品包括 (HQ ST is established for every product. This includes products that are produced)：
  - 自己生產的產品 (by ourselves and bear our brand name)；
  - 外發生產的產品 (by other companies yet bear our brand name)；
  - 外來加工的產品 (by ourselves and bear other brand names)。

5) 建立和維護理論標准時間的職責(Responsibility of HQ ST establishment and maintenance)。

- ❑ 公司總部負責建立和維護理論標准時間 (By headquarter of each business group)。

6) 什么是實用標准時間? (What is SPEC/SUB-con ST?)

a. 實用標准時間就是一個操作者在現有的生產方式下用最有效的生產方法去完成一項操作所需的最短時間 (SPEC/Sub-con ST is the shortest possible time required for an operator to perform an operation in the most efficient manner and with the given production system)。

- ➢ 現有的生產方式: 是指操作者采用現有的生產設備或工具以及操作標准 (Given production system: The operator is using the given equipment or tool and following the given operation sandard)。

b. 實用標准時間包括所有列明在操作標准中的“暫時必須的操作時間(替代流程)" { SPEC/Sub-con ST includes time required for all “temporarily necessary operation" that is listed in OS}。

- ➢ 暫時必須的操作: 因為一些材料的質量問題, 需要額外的檢查去保証成品的質量, 每一個“暫時必須的操作(替代流程)"都必須加入操作標准中。在預算時, 應預計這些原材料問題將會持續, 因為沒有辦法去解決這些問題。所以執行這些“暫時必須的操作(替代流程)"所需的時間應包括在實用標准時間里 {Temporarily necessary operation(TNO): because of some material quality problem, additional check is required to ensure quality of the final products. A TNO is added to the OS. During budget, it is expectted that this raw material problems will persist, because no countermeasure has been found to eliminate this problem,than the time required to perform this TNO is included in SPEC ST}。
- ➢ 每次預算時都必須對“暫時必須的操作(替代流程)"進行檢討 (TNO should be review every budget)。

c. 實用標准時間是已知的實際淨時間 (SPEC/Sub-con ST is also known as actual net time)。

7) 實用標准時間的范圍 (Scope of SPEC / Sub-con ST)

- ❑ 由制造每种產品的承包商制定實用標准時間 (SPEC/Sub-con ST is established for every product made by SPEC and sub-contractors of SPEC.)

8) 建立和維護實用標准時間的職責 (Responsibility of SPEC/Sub-con ST Establishment and Maintenance)

a. 各個生產部門 (By the respective production department)。

b. 實用標准時間的修改只是在預算期間，而且應該在預算后 6 個月不變 (Amendment of SPEC/Sub-con ST is only possible during budget period. Moreover, it should be held constant for the 6 months budget period).

9) 為什么需要理論標准時間 (Why do we need HQ ST)?

- 理論標准時間用來比較不同的承包商的表現，因此實用標准時間被用于 (When we need to compare performance of different manufacturing plant making our products, HQ ST is used)：
  - 效率的計算 (In the efficiency calculation)。
  - 作為一項加工方法水平的指標 (As an indicator or clue of level of manufacturing method)。

10) 為什么需要實用標准時間 (Why do we need SPEC/Sub-con ST)?

a. 去比較不同的生產部門和承包商制造產品的表現 (To compare performance of different production departments and sub-contractors making products)。
  - 效率 (Efficiency)。
  - 加工水平 (Level of manufacturing)。

b. 被用在生產計划和控制 (To be used in production planning and control)。
  - 因為實用標准時間是當前生產方式的最好描述 (Because SPEC/ Sub-con ST best describe the given production system)。

c. 被用在過程設計和改善活動 (To be used in process design and improvement activities)。
  - 如生產線平衡、損失分析等 (e.g.. Line Balancing，Loss Analysis)。

11) 如何建立實用標准時間 (How to Establish SPEC/Sub-con ST)?

a. 實用標准時間不是用時間研究去測量 (SPEC/Sub-con ST is NOT measured by time study)。

- ➢ 除机器控制時間 (Except for machine controlled time)。

b. 實用標准時間的計算是 (SPEC/Sub-con SST is calculated by):

- ➢ 首先用 SONY 的標准時間數据 {First using Sony Standard Time data(SSTD)}。
- ➢ 如果這個操作沒有列出在 SONY 的標准時間數据里，那么這個操作的標准時間用工作研究來計算 {If the operation is NOT listed in SSTD，then ST of that operation is calculated by using detail work factor (DWF)}.

c. 最終的方法(現在實行的) {Latest Plan (Current practice)}。

- ➢ 用 MOST 計算實用標准時間 (Calculate SPEC/Sub-con ST using MOST)。

12) **標准時間的計算方法** (Guidelines on ST calculation)。

- ❑ 計算標准時間的重要原則是：當建立半自動操作(人操作机器)的標准時間時，注意應該不要當作重复操作，而是同時去執行的 (Important rule: When establishing ST for semi-automated operation, care should be taken not to double count operations that can be performed simultaneously)。

2. Sony 標准時間 - 機器運作時間 {Sony Standard Time (SST) - Machine tact}

1) 什么是机器運作時間 (What is Machine Tact)?

- ❑ 設備或机器執行操作的 Sony 標准時間 (Sony Standard Time for operation performed by Equipment, or machine is known as Machine Tact)。

2) 机器運作時間的范圍 (Scope of Machine Tact)

- ❑ 机器運作時間應該被建立在所以用設備生產 Sony 產品操作中 (Machine tact should be established for all operations performed using equipment which produces Sony products)。

3) 定義 (Definition)

a. 机器運作時間是用一台由熟練操作者控制的机器去加工產品的最短合理時間。机器運作時間應符合以下條件 {Machine tact is the shortest reasonable time for a part to be processed by a machine under the control of a skillful operator (or maintenance staff). The following conditions should be fulfilled}:

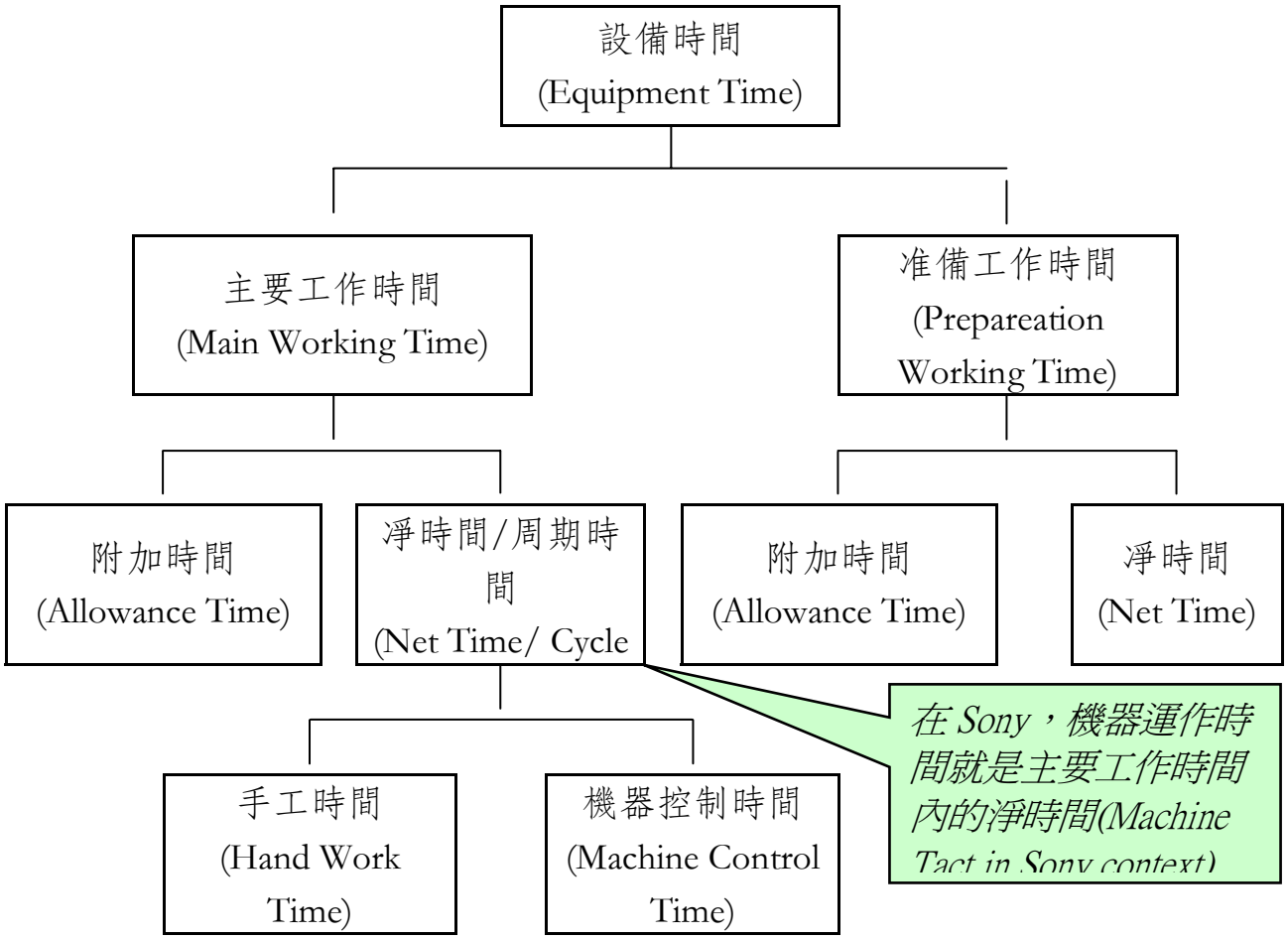
- 按操作標准操作設備 (Equipment is operated according to the operation standard)。
- 設備正常維護 (Equipment is well maintained)。
- 產品生產遵守質量標准 (Products produced conformed to quality standard)。

b. 机器運作時間不包括 (Machine Tact should NOT include)：

- 停机時間損失 (Time loss due to machine down)。
- 附加時間 (Allowance time)。

c. 材料質量的暫時變化不要調整机器運作時間 (Temporary change in material quality does NOT justify for Machine Tact revision)。

4) 設備時間 (Equipment Time)



第二節： 目的(OBJECTIVES)

1. 目的(Objectives)

1) 發掘一個最好的工作方法 (To Develop One Best Method)。

2) 建立合理的工作時間 (To Establish Fair Work Time)。

2. **建立標准時間的三個步驟 (3 Steps For Establishing Standard Time)**

1) 分析 (To Analyse)。

2) 簡化 (To Simplify)。

3) 培訓操作者 (To Train Operator)。

第三節：導言(INTRODUCTION)

1. **三個決定因素 (3 Determining Factors)**

1) 做什么 (What should be done)?

2) 怎么去做 (How it should be done)?

3) 做多長時間 (How long it should take)?

2. **工作量度 (Work measurement)**

1) 你想去管理，你必須控制 (You want to manage, you must control)。

2) 如果你想去控制，你必須量度 (If you want to control, you must measure)。

3. **工程師、主管和經理必須能 (Engineers, supervisors and managers must be able to)：**

1) 描述做這項工作所必須的動作 (Describe the necessary activities required to do the job)。

2) 說明可有效利用的人力和設備 (Specify the efficient use of manpower & equipment)。

4. **工作量度方法的好處 (Adavantages of work measurement tools)**

1) 它提供了一個能定量評估工作方法的方法理論 (This tool provides a methodology to evaluate & quantify the methods of work)。

2) 它提供了一個方法理論去保証工程方法和糾正方法 (This tool provides a methodology to undertake Methods Engineering & Method Corrections)。

3) 它能夠提供製造者的相關信息 (Its enable members of the manufacturing team to be provided with information regarding)：

a. 每項工作的數量 (The amount of work in each job)。

b. 方法 (The Method)。

c. 工作流程 (The flow of work from one task to another)。

5. 為什么我們要采用工作量度方法 (Why we use this Work Measurement Tool)?

1) 快速 (Fast)。

2) 系統化 (Systematic)。

3) 准确 (Accurate)。

4) 減少人為失誤 (Reduction of applicatior’s erreors)。

5) 減少文書工作 (Reduces paper work)。

6) 在管理標准上，這種方法可用來完成 (At management level, this tool accomplishes)：

a. 計划和預算 (Planning & budgeting)。

b. 績效管理 (Performance management)。

c. 确定成本 (Cost establishment)。

7) 在操作標准上，這種方法能使 (At operation level, this tool provides)：

a. 保持標准時間一致 (Consistent time standard)。

b. 減少投訴 (Reduces grievances)。

c. 加強操作者的信心 (Increases operator’s confidence)。

6. 動作順序描述 (Motion sequence describes)

1) 手的動作 (Movements of hands)。

2) 身体的動作 (Movements of body)。

3) 裝配方法 (Assembly methods)。

7. 所有的人力工作可以用下面的三個順序描述 (All manual work can be describes in 3 sequences)

1) 一般動作順序 (The general move sequence)。

2) 受控動作順序 (The controlled move sequence)。

3) 使用工具的順序 (The tool use sequence)。

第四節：一般動作的順序

1. 一般動作的順序 {General Move Sequence (GMS)}

1) 一般動作順序處理一個物体的空間移動 (The general move sequence deals with the spatial displacement of an object)。

2) 在手的操縱之下，物体的運動軌跡沒有限制 (Under manual control, the object follows an unrestricted path through the air)。

A B G	A B P	A
(Get)	(Put)	(Return)

- ❑ A - 動作距离 (Action distance)。
- ❑ B - 身体動作 (Body motion)。
- ❑ G - 拿 (Gain control)。
- ❑ P - 放 (Place)。

🔔 **標准時間分析的例子 (Example of standard time analysis)**

- ❑ 走 3~4 步去到在地上的一個書簽前 (Walk 3 or 4 steps to a marker on floor)；
- ❑ 彎腰撿起它再直起身 (bend and rise to pick it up)；
- ❑ 然后走 3~4 步將書簽放在木板上 (and walk 3 or 4 steps to place marker on the board)。

A6B6G1 A6B0P1 A0 = 200

或(OR)

A6B3G1 A6B3P1 A0 = 200

Working：各指示值的總和 (Sum of Indices) = 20

- ❑ TMU = 20 X 10 = 200 = 200 X 0.036s = 7.2s

2. 動作距离參數 (Action Distance Parameter) - [A]

1) 動作距离 (Action distance) - A

- ❑ 包括手指、手和腳拿、放物体之所有的空間動作(包括長或短距离搬運重物之拿的動作) {Covers all spatial actions of the fingers, hands, and / or feet loaded / unloaded (Values can include loaded moves for when carrying something heavy one takes more(shorter) steps.)}。

A　0　1　3　6　10　16

2) 動作距离所涉及的空間動作包括 (Action Distance, covers all spatial actions of the)：

a. 手指，手 (Fingers, Hands)，

b. 腳 (Feet)，

c. 拿或放 (Loaded or unloaded)。

🔔 注意 (Note)：

- 用手或手指的動作距离不超過 2”(5cm)時允不計時，用 A0 表示 (No time is allowed for action distance of less than 2”(5cm) with the hand or fingers. This is denoted by A0)。

3) A0 - 短距离 (Short reach)

d. 范圍小于 2”(5cm) {Reach of less than 2”(5cm)}。

a. 計時包括 (Time is included in)：

- 拿的參數 (Gain control parameter) - [G]
- 放的參數 (Place parameter) - [P]

b. 在連續循環中到達的時間算在下一個循環的第一個動作距离 (Reach in a continuing cycle as time is accounted for in the first action distance of the next cycle)。

4) A1 - 隨手范圍 (Within reach)

a. 手的范圍 (Hand reach)

- 用或不用身体的幫助隨意可將手触到物体 (Reach to object within reach with or without body assistance)。
- 沒有身体的移動 (No body displacement)。
- 包括身体的幫助 (Body assistance is included)。

b. 腳的動作 (Foot action)

- 用腳踏 (Reach to pedal with the foot)。

5) A3 - 1~2 步 {Steps(1 TO 2)}

a. 在身体移動即可触及的范圍外 (Out-of reach object more than a simple displacement of body)。

b. 1~2 步的身体移動 (Body displacement by one or two steps)：

- 走向一邊 (Stepping to the side)。
- 轉身 (Turning the body around)。

c. 每一步腳都踏在地上 {Each step(body displacement) with foot hitting the floor}。

d. 移動及步距均匀 (Average step distance is depending on average displacement)。

e. 适用于上下正常的坡度 (Value application to climbing or descending normally inclined)。

6) 較大動作的距离 (More action distances)

- A6 - 3~4 步 {Steps (3 to 4)}。
- A10 - 5~7 步 {Steps (5 to 7)}。
- A16 - 8~10 步 {Steps (8 to 10)}。

3. 身体動作參數(Body motion parameter) - [B]

B 3 6 10 16

身体動作是指身体的直上或直下或一些克服阻礙或損傷的身体動作 (Body Motion refers to either vertical(up or down) motions of the body or some obstruction or impairment to body movement)。

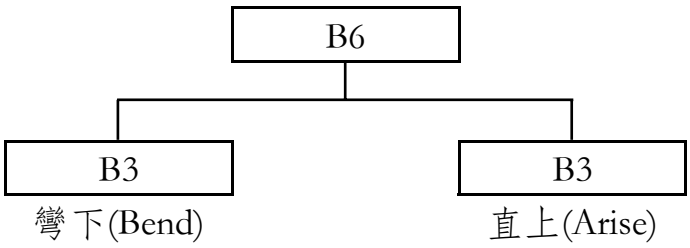
1) B3 - 彎下和直上(50%的發生率) {Bend and Arise(50% Occurrence)}。

- 彎下和直上的動作每次發生只有 50%，如堆或卸一些物体 (Bend and Arise occurs only 50% of the time during a repetitive activity, such as stacking or unstacking several objects)。
- 那么 (Also)：
  - B3 = 彎下 (Bend Down)
  - B3 = 直上 (Arise Bend)

2) B6 - 彎下和直上 (100%){Bend and Arise (100%)}。

- 身体從直立向下彎曲允許雙手触及到膝蓋以下位置然后回到直立位置 (From an upright position the body is lowered to allow the hands to reach to or below the knees and subsequently return to an upright position)。

- 手不必一定要到膝蓋以下，只要身体充分彎下 (It is not necessary for the hands to actually reach below the knees.Only the body is lowered sufficiently to allow the reach)。



3) B10 - 坐或站(包括所有用手推的動作，椅子的移動) {Sit or stand (including all manipulative movements - side steps, movement of chairs)}。

- 包括椅子所在位置或身体開始的位置及身体移動后所有手、腳、身体的動作 (This value includes all of the hand, feet and body motions required to position the chair or situate the body prior to or after the body motion)。
- 并且 (Also)，
  - B3 - 坐 (Sit)：如果椅子的位置或身体開始的位置沒有移動就坐下 (If there is no motion to position the chair or situate the body prior to sitting down)。
  - B3 - 站 (Stand)：如果站起來時身体、椅子及桌子所處的位置沒有移動 (If there is no motion to situate the body, chair, table in the act of standing)。

4) B3 - 坐(沒有手的動作) {Sit only (No manipulative movements)}。

5) B3 - 站(沒有手的動作) {Stand only (No manipulative movements)}。

6) B16 - 穿過門(包括走到門前、開門，用 3~4 步走過門和關門) {Through door (include reach to door, opening door, take 3 to 4 steps to walk through door and closing door)}。

- 穿過門(鉸鏈，雙重或回旋)的動作由：走到門前開門，穿過門口及隨后關門 {Passing through a door (hinged, double or swinging) consists of reaching for and opening the doors,walking through the doorway and subsequently closing the door}。

- ❑ 在動作行程參數中不算穿過門口需走的 3~4 步 (Do NOT include those 3 to 4 steps used to walk through the doorway in the action distance papameter)。

7) B16 - 爬上或爬下 (Climb on or off)

- ❑ 包括爬上或爬下用到的所有手、腳和身体動作 (Includes a number of hands and body motions required to climb on to or off of a loading dock type platform, or climbing into a truck frame)。

4. 拿的參數 (Gain Control Parameter) - [G]

1) G - 拿 (Gain control)

- ❑ 包括所有的身体動作(手指，手和腳)。需要去獲得一個或几個物体并且隨后离開 {Covers all manual motions (mainly fingers, hands and feet). Required to obtain complete control of an object or objects and subsequently relinquish that control}。

2) G1 - 輕物 (Light object)

- ❑ 可以用一只或兩只手只去拿一件物品。這個物品可能混在其它物品中，但用手指、手、腳或一個組合動作較容易就可拿到可以用一只或兩只手只去拿一件物品。這個物品可能混在其它物品中，但用手指、手、腳或一個組合動作較容易就可拿到 {Can be performed by one or two hands as long as only one object is obtained. The object may be jumbled with other objects, lying close against a flat surface or simply lying by itself. Control may be gained by simply touching the object (contact grasp) with fingers, hand or foot or by a more complex grasping action}。
  - ➢ 用一只或兩只手去拿一件物品 (One object is obtained by one or two hands)。
  - ➢ 單獨或混放 (By itself or in a jumble)。
  - ➢ 在平面上 (Lying on a flat surface)。
  - ➢ 拿的動作 (Complex grasping action)。
  - ➢ 手指，手或腳 (Fingers, hand or foot)。

例如(Example)：

- ❑ 拿起電話話筒 (Pick up a telephone receiver)。

- ❑ 從墊圈盒里拿一個墊圈 (Obtain one washer from parts bin full of washers)。
- ❑ 從桌上拿表格 (Obtain sheet of paper lying on desk)。
- ❑ 用雙手撿起一本手冊 (Pick up a manual using both hands)。
- ❑ 按電梯按鈕 (Gain control of an elevator button)。

a. G1 - 几個物品 (Several objects)

- ➢ 如果几個物品放在一起或能夠當作一件物品拿，用 G1 (If several objects are grouped toghter or arranged in such a way that they can be picked up as an object, G1 will apply)。

例如 (Example)

- ❑ 几支鉛筆放在筆筒里 (Several pencils standing together in a holder)。

b. G1 - 拿 (Obtain control)

- ➢ 用一只手拿一件物品 (Obtain control of one object with one hand)。

c. G1 - 同時拿(同時) {Obtain control (SIMO)}

- ➢ 拿一件物品的同時拿另外一件物品 (Obtain control of one object while at the same time gaining control of another object simultaneously)。

d. G1- 輕物(同時) {Light object (SIMO)}

- ➢ 兩只手同時拿兩件物品 (Gaining control of two objects simultaneously - both hands)。

Examples 例如 :

- ❑ 一手拿錘一手拿釘 (Hammer and nail lying side by side)。
- ❑ 一手從滿的盒子里拿墊圈，一手從別處拿螺栓 (Washer from one full parts bin and a bolt from another)。

3) G3 - 拿 (Obtain control)

a. G3 - 輕物(不同時) {Light object (Non-SIMO)}

- ➢ 限制動作發生的時机，兩手相同距离的動作“A "組成，但是有先后順序 (This values will be used when there is limited practice opportunity available. The activity consists of a SIMO action distance

"A" with both hands but the grasping of the objects is two separate actions)。

- 拿取物件的重量 (Obtain control with weight)
  - 輕物 (Light object) < 2 公斤 / 手 (kg / hand)
  - 重物 (Heavy object) > 2 公斤 / 手 (kg / hand)

b. G3 – 稍重物体 (Easy heavy)

- 你可以用移動物体前需要施加力量的大小來識別一個 G3 的重物 (You can identify a G3 heavy object by the hesitation or pause needed for the muscles to tense up prior to lifting)。
- 重量的作用可以隨物体的形狀和位置來改變 -一個重的帶把皮箱比 一個重的紙板箱較容易拿起 (The effect of weight can be influenced by the shape and location of an object - a heavy briefcase with handle is easier to gain control of than a heavy card-board box)。

- 例如 (Example)：
  - 從地上拿有柄的蓄電池 (Get hold of auto battery on floor)。
  - 用力推沉重的箱子 (Brace body before pushing heavy box)。
  - 握住手推車的把手推 (Take hold of hand cart before pulling)。

c. G3 - 阻隔 (Blind or obstructed)

- 手指必須去摸索一個物品或消除障礙拿到物品 (The fingers must either "feel around" for an object or "work around" an obstruction to reach the object)。

- 例如 (Examples)
  - 從板另一邊的拿一個散布的墊圈 (Obtain a washer from a stud located on the other side of a plate)。
  - 伸手到空气清洁器后面的插頭 (Reach for spark plug located behind the air cleaner)。

d. G3 - 解開 (Disengage)

- 用力釋放(分离)一個物体。運用反沖壓力，物体在空中經過一個無限制的運動途徑 (Apply muscular force to free the object. The

application of pressure followed by a recoil, the object travels through an unrestricted path through the air)。

- 例如 (Examples)：
  - 打開鋼筆套 (Remove cap from pen)。
  - 調節棘輪工具的固定限位銷 (Remove tightly fitting socket from a ratchet tool)。
  - 開瓶塞 (Remove cork from a wine bottle)。

e. G3 - 連結 (Interlocked)

- 一個物体和其它物体混纏在一起，并且獲得控制前必須分离 (The object(s) is intermingled or tangled with other objects and must be "worked free " before control can be achieved)。

- 例如 (Examples)
  - 從工具箱底拿一把錘子 (Removes a hammer from the bottom of a tool box)。
  - 從一個彈簧盒子里面拿彈簧 (Pick up one spring from a box of springs)。

f. G3 - 收集 (Collect)

- 物品混亂的堆放在一起或散布，如果堆積，要用手指挖下去拿出一把。如果散布，拿之前手指必須把物品掃到一起 (Objected are either jumbled together in pile or spread out. If jumbled, control of several objects is achieved by digging the fingers down into the pile and bringing up a handful. If spread out, the fingers must sweep the objects together before gaining control)。

- 例如 (Example)
  - 從一個盒子里抓一把釘子。(注意：在一個零件箱里面挑選一顆釘子，用 G1) {Grasp a handful of nails from a bin. (Note: If only one nail was selected from many in a parts bin , it would be a G1)}。
  - 拿起一支鋼筆，一支鉛筆，一塊橡皮，每次一個手動作 (Pick up a pen, pencil and eraser, spread out a desk, in one motion with one hand)。

4) G6 - 沉重 (Difficult heavy)

- ❑ 一個重的物体很難拿。尤其是沒有把手的重箱子 (Obtaining control of a heavy object with difficult grasps. Especially a heavy box without holes or handle)。

5. **放的參數 (Placement parameter) - [P]**

1) P - 放 (Place)

- ❑ 包括在一個物体移動的最后階段里的所有動作，放手前將物体進行排列、調整以及將物体放在指定的位置 (Includes all motions in the final stage of an object ’ s displacement, for the purpose of aligning, adjusting, and / or placing the object in a more or less defined location before control is relinquished)。

2) P0 - 沒有放 (Place zero)

a. P0 - 握住 (Hold)

- ➢ 一件物品沒有放下而只是拿到一個距离為“A " 的位置并握住，例如拿一張工作卡到面前讀上面的內容 (The object is not placed but merely brought to a location with an action distance “A " and held. An example of this would be to get a job card and bring it to the front so that it can be read)。

b. P0 - 扔 (Toss)

- ➢ 沒有放的動作發生，物体被扔到動作距离結束的地方 (No place parameter occurs, the object is released at the end of the action distance. The action distance value will still apply)。

🔔 **例如 (Examples)：**

- ❑ 完成品扔到箱子里 (Toss finished part into bin)。
- ❑ 將紙捏成團扔進垃圾罐里 (Toss balled up paper into trash can)。

3) P1 - 放 (Place)

a. P1 - 放到一邊 (Lay aside)

- ➢ 物体放到一邊不用調整 (Move object aside with no alignment or adjustment)。

🔔 **例如 (Examples)：**

- ❑ 放開鉛筆 (Aside pencil)

- ❑ 手冊放在桌上 (Lay manual on table)。

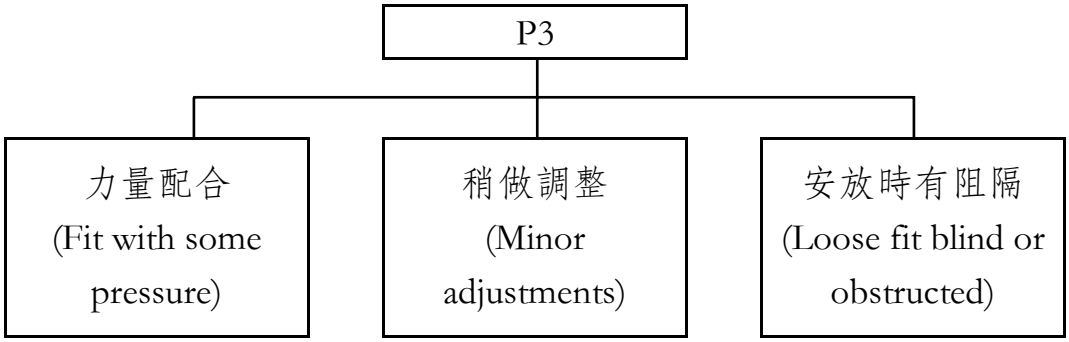
b. P1 - 安放 (Loose fit)

- ➢ 要求有一個調整。容許松動，保証物体無壓力 (One adjustment is required to bring to a pre-determined relationship with its destination. Tolerances are loose enough to require no pressure to engage the objects)。

例如 (Examples)：

- ❑ 墊圈放到螺栓上 (Place washer on bolt)。
- ❑ 放兩角五分錢到售買机里 (Insert quarter in vending machine)。
- ❑ 放下電話話筒 (Hang up telephone receiver)。

4) P3 - 放 (Place)



a. P3 – 輕壓 (Light pressure)

- ➢ 由于接近容許量或自然放置，需要給予物体壓力 (Due to close tolerances or the nature of the placement, muscular force is needed to seat the object) 。

例如 (Example)

- ❑ 在信封上蓋印 (Place moist stamp on envelope)。
- ❑ 圖釘按進木板里 (Press thumb-tack into cork board)。
- ❑ 電源插頭插入插座 (Insert electric plug into socket)。

b. P3 - 調整 (Adjustments)

- ➢ 通過触摸或調整物体來識別物体所放的位置。 (Recognised by obvious fumbles or adjustments of the object at the point of placement)。

- 調整：任何用手或腳去确定物体的成向或排列物体而發生在物体放置點的動作 (Adjustment - any hand or finger motions occurring at the point of placement to orient or align the object)。

例如 (Examples)

- 打孔器打孔 (Align center punch to scribe mark)。
- 回形針夾紙 (Place paper in notebook binder)。
- 鑰匙放進鎖里 (Place key in lock)。
- 螺絲批放進螺絲孔里 (Place screw-driver in screw slot)。
- 把一些紙收起來理整齊 (Jog papers to straighten)。
- 穿一條繩子系牢物体(開始穿繩) {Place a thread fastener (Initial start of threads)}。

c. P3 – 放兩次 (Double)

- 在這個放的動作包括一個或兩個物体時，并出現兩個不同時間的放置。兩個位置間必須有一個調整 (Two distinct placements occur during the placing activity involving either one or two objects. There must be an adjustment between the first and second placements for double placement to apply)。

例如 (Example)

- 螺栓穿過螺孔，然后上螺母 (Place bolt through hole, then nut on bolt)。
- 螺栓穿過板，然后栓緊在發動机架上 (Place bolt through plate and fasten to engine mount)。

d. P3 – 媒介動作 (Intermediate move)

- 同樣大小的物体或不同大小的物体不用選擇，如隨便放一些硬幣進投幣孔 (Objects of the same size or different size objects where no visual selection is required as in randomly placing a handful of coins into a coin-slot)。

注意 (Note)：

- 如果硬幣已經拿在手指間只需稍微的調整并很容易地投入，只要 P1 就可以了 (If the coin is already held between the fingers for loose insertion with fingers for loose insertion with one adjustment, only P1 is allowable)。

5) P6 - 放 (Place)

a. P6 – 媒介動作 (Intermediate move)

- 放置一個物体前，几個手指和手動作需要從手掌到指間選擇和轉移一個或几個不同的物体。包括物体的翻動和挑選。重而大的物体也許要求一系列的放，再抓和移動的動作 (Before placing an object, several fingers and hand movements are needed to select and shift one of several different objects from the palm to the fingertips. Including turning the hand over and visual selection of the object. Heavy or bulky items may require a series of placing, regrasping and moving activities)。

注意 (Note)：

- 如果所有的物体是一樣的，這些中間動作不算 (If all objects are the same, the intermediate move is accomplished internal to the action distance)。

例如 (Example)：

- 從一把硬幣中用手指推一個一毛錢的硬幣到指尖，并放入投幣器 (From a handful of change, use the thumb to push a dime to the fingertips and place it in a vending machine)。
- 將一個大箱子放到牆角，然后使它緊靠墻 (Place large box down on its corner and "walk" it into the place against a wall)。

b. P6 - 精确 (Care / precision)

- 放置物体時需要看准和/或用力去控制，在放置時用明顯的"慢動作" (Extreme visual and / or muscular control is needed. Characterized by obvious "Slow Motion" during placement)。

例如 (Examples)：

- 穿針線 (Thread a needle)。
- 复雜的線路板焊錫 (Place soldring iron to crowded circuit connection)。

c. P6 - 重壓 (Heavy pressure)

- 例如一個非常持久的密封(物体不重)，需要一個大的力量去保証。特點是反复抓住物体和保持用力 (As a result of very tight tolerances (not the weight of the object), a high degree of muscular

force is needed to engage the object. Characterised by regrasping the object and hesitation for tensing the muscles)。

- 注意 (Note)：
  - 重物對于選擇放的指標值沒有影響。不過，重和/或大也許會引起調整將影響放置的指標值 (The weight alone has no effect on the choice of an index value for place. However, weight and / or bulk may cause adjustments which will influence the placement value)。
- 例如 (Examples of heavy pressure)：
  - 將一個巨大的箱子推進另外兩個箱子之間 (Pushing a large box into its place between two other boxes)。

d. P6 - 阻隔 (Blind or obstructed)

- 放置之前要求用一些手和手指的動作去摸索和感覺 (Several hand or finger movements are required to work the object around obstructions or feel around the destination before placement can occur)。

- 例如 (Examples)：
  - 將螺母擰到隱蔽的螺栓上 (Place nut on hidden bolt)。
  - 將火花塞放進發動机 (Place spark plug in engine block)。
  - 將電源插頭插入桌子后面的插座 (Place electric plug in socket located behind table)。

6. 一般動作順序練習

填充下面每個例子的順序并計算順序的時間，比較你的和老師的結果 (Fill out the sequence model following each example and calculate the sequence time in TMU)。

1) 左手拿一支針，右手拿一根線，線穿過針眼 (With sewing needle in the left hand, pick up a piece of thread with right hand and place through needle eye)。

   A B G A B P A =_____TMU

2) 從座位上拿一支鈍的鉛筆，并走 8 步將鉛筆放進鉛刨里 (From a seated position, pick up a dull pointed pencil and place it in a sharpener located 8 steps away)。

A B G A B P A =_____TMU

3) 從你的口袋里拿一把零錢并且投一個一毛的硬幣和一個 5 分的硬幣到投幣器里 (Take a handful of change from your pocket and place a dime and a nickel into a vending machine)。

A B G A B P A =_____TMU

4) 從桌子上拿一個回形針并且把它彆到另一只手拿的紙上 (Take a paper clip from the table and attach it to papers in the other hand)。

A B G A B P A =_____TMU

5) 用右手取下左手拿的鉛筆上的帽，并將鉛筆和帽放在桌子上的一邊 (With the right hand, remove the snugly fitting cap from a pencil being held by the left hand and put aside both cap and pencil on the table)。

A B G A B P A =_____TMU

6) 一個工人站在一張長凳前走過去在 10 步(3 米)從地上搬起一件重物再回來并放在長凳上 {An operator standing in front of a bench gets a heavy part from the floor and places it on the bench. The distance from the bench to the part is 10 feet (3m)}。

A B G A B P A =_____TMU

7) 用兩手從桌子上搬一件重物，走 5 步放到在地上的盤中，沒有調整并返回到桌前 (Using 2 hands take a heavy part from a table, walk 5 steps, place the part in a tote pan located on the floor, with no adjustments and return to the same table)。

A B G A B P A =_____TMU

8) 用兩手拿在桌子上的鉛筆和橡皮放到這張桌子打開的抽屜中 (Using 2 hands, pick up the pencil and eraser lying on a desk within reach and place them in an open drawer)。

A B G A B P A =_____TMU

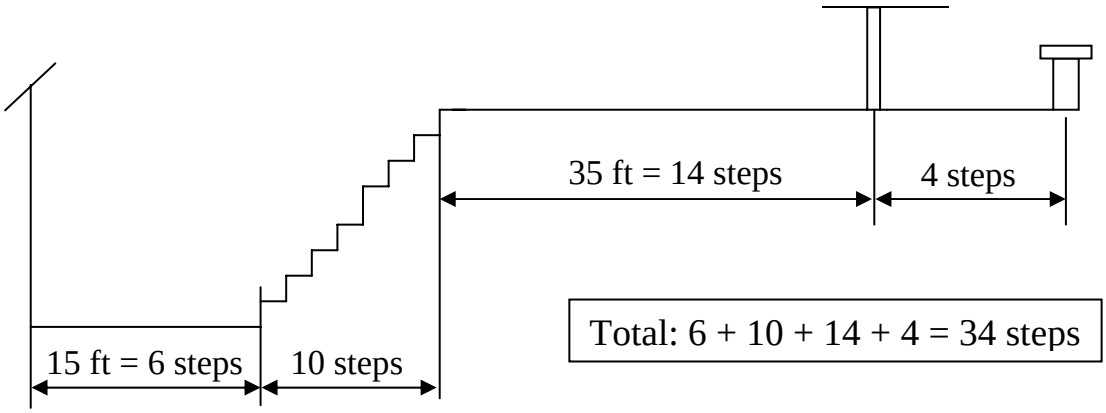
9) 坐在桌邊，收起一些表格紙并輕輕地磕在桌上理齊 (While seated at desk, collect several sheets of paper together and jog against desk top to straighten)。

A B G A B P A =_____TMU

10) 一個職員從盒子里拿一封信然后送到樓上的另一個辦公室，他必須穿過辦公室的門，把信放在桌上后离開這個辦公室，并關上門返回到起點。

(請看下圖) {A clerk obtains a letter from a box (within reach) and delivers it to another office located upstairs. He must pass through the office door, lay the letter on a desk, leave the office and close the door before returning to his starting point. The stairs (10 steps high) are 15 feet (4.6m) from his starting point and 35 feet (10.7m) from the office door, (which is 4 steps from the desk)}。

A B G A B P A = _____ TMU



第五節：受控動作順序

1. 受控動作順序 {Controlled Move Sequence (CMS)}

1) 物体是在一條“受控"途徑上被移動。這個物体的移動至少受到一個方向的限制 (Describes the manual movement of object over a “controlled” path. The movement of the object os restricted in at least one direction by contact with, or an attachment to another object) 。

ABG	MXI	A
拿(Get)	移動或開動(Move or actuate)	返回(Return)

- ❑ A - 動作距离 (Action distance)。
- ❑ B - 身体動作 (Body motion)。
- ❑ G - 拿 (Gain control)。
- ❑ M - 受控移動，包括所有用手引導的物体在受控的途徑上移動或動作 (Move controlled, covers all manually guided movements or actions of an object(s) over a controlled path)。
- ❑ X - 工時，這個受控的工作是用机器而不是人力 (Process time, the work controlled by processes or machine and not by manuual actions)。

- ❑ I - 對准，移動物体并控制方向，按刻度或目標點調整物体 (Align, refers to manual actions following the controlled move to achieve the alignment of objects)。

2) 受控動作 (Controlled move)

- ❑ 一個物体連接或依附在另一個物体的動作。(如：移動一個箱子穿過一張桌子，轉換齒輪，按按鈕等) {Any move where an object is in contact with or attached to another object. (Example: Sliding a box across a table, shifting gears, pushing a button, etc.) 。

2. 受控動作參數 (Moved Controlled Parameter) - [M]

1) M1 - 受控動作 (Move controlled)

a. M1 - 推 / 拉 / 旋轉 (Push / Pull / Pivot)

- ➢ 距离小于或等于 12 英寸(30.48cm)：手指、手或腳移動物体不超過 12 英寸(30.48cm)的距离 {Less than or equal to 12 inches (30.48cm): Object is displaced by movement of the fingers, hands or feet not exceeding a distance of 12 inches (30.48cm)}。

🔔 例如 (Examples)：

- ❑ 電話撥號 (Dial telephone)。
- ❑ 用腳踏离合器 (Press clutch pedal with foot)。
- ❑ 按線路板進切腳机 (Operate feed lever on cutting machine)。

b. M1 - 按鈕 / 開關 / 旋鈕 (Button / Switch / Knob)

- ➢ 用手指，手或腳的一個短暫的點擊，轉移或轉動使這個裝置動起來 (The device is activated by a short pressing, moving or turning action of the fingers, hands or feet)。

🔔 例如 (Examples)：

- ❑ 按電話號碼鍵 (Press telephone hold button)。
- ❑ 輕擊牆上的照明開關 (Flip wall light switch)。
- ❑ 轉動把手開廚柜 (Turn knob to open cabinet)。
- ❑ 轉換電視頻道 (Turn TV station selector knob one notch)。

2) M3 - 受控動作 (Move controlled)

a. M3 – 移動距离大于 12 英寸 (30.48cm) {Greater than 12 inches (30.48cm)}

- 物体的移動距离大于 12 英寸，移動之前，有拔掉門拴或解開物体的小動作 {Object moved a distance greater than 12 inches (30.48cm). Short actions may be included to unlatch or unhook the object before movement}。

例如 (Examples)：

- 拉起重机鏈條 (Pull chain hoist)。
- 打開很長的文件柜 (Open file drawer full length)。
- 坐在帶輪的椅子上用腳推离桌子 (While sitting in a swivel chair, push away from desk with feet)。

b. M3 - 克服阻力 (Resistance seat / unseat)

- 用力克服摩擦力或阻力去移動。距离不超過 12 英寸(30.48cm) {Muscular force is required to overcome friction. It may be required to seat or unseat the object or simply to sustain movement of the object against resistance. Up to 12 inches (30.48cm) of movement is included}。

例如 (Examples)：

- 在桌子上推重的紙箱 (Push heavy carton across table)。
- 用扳手擰緊螺母 (Final turn of nut with wrench)。
- 緊急刹車 (Pull up emergency brake)。

c. M3 - 精确控制 (High control)

- 在允許范圍內慢慢移動，避免損傷，或在物体移動的時候保持物体特定的方向。在動作結束期間有必要注視物体和物体周圍環境的聯系 (Movement is slowed to keep within tolerance limits, prevent injury or damage, or maintain a specific orientation of the object during a controlled move. There must be eye contact with the object and its surroundings either during or at the end of the ove)。

例如 (Examples)：

- 轉動保險箱的刻度盤，對正密碼刻度 (Turn a safe dial to a specific number without going past the number)。

- ❑ 徒手划直線 (Draw a straight line without using a straight edge)。

d. M3 - 兩個階段距离和小于或等于 12 英寸 (30.48cm) {2 stages less than or equal to 12 inches (30.48cm)}

- ➢ 物体在兩不同方向且每階段長度不超過 12 英寸 (30.48cm) 的移動，并且沒有控制 (Object displaced in two different directions or increments not exceeding 12" (30.48cm) per stage and without giving up control)。

🔔 例如 (Examples)：

- ❑ 開關小汽車內的儲物箱 (Open and close glove compartment of a small car)。
- ❑ 轉換杆后退和向前 (Shift lever back and forth)。
- ❑ 開關抽屜 (Pull drawer out and push in)。
- ❑ 蓋原子印 (Rubber stamping (Self-inking)。

3) M6 - 兩個階段超過 12 英寸 (30.48cm) {2 stages greater than 12" (30.48cm)}

a. 物体移動的每個階段超過 12 英寸 (30.48cm) 并且沒有控制 (Displacement of object exceeds 12" (30.18cm) per stage without giving up control)。

🔔 例如 (Examples)：

- ❑ 1. 開關冰箱門 (Open and close refrigerator door)。
- ❑ 2. 上下移動水泵手柄 (Move water pump handle up and down)。
- ❑ 3. 開關附件箱 (Open and close attached case)。

b. 一個階段小于或等于 12 英寸 (30.48cm), 另一個階段大于 12 英寸 (30.48cm), 這個移動一定要分析兩個受控動作的上下 (For two-stage moves in which the distance of one stage is 12" (30.48cm) or less and the other stage is over 12" (30.48cm), the activity must be analyzed with two controlled move sequences)。

🔔 例如 (Examples)：

- ❑ 一件物品滑動 6 英寸后，然后轉向 90 度的方向再滑動 18 英寸 (An operator slides a part 6" (15.24cm) to obtain clearance. Without giving up control, the part is slide 18" (45.72cm) in a 90 degree direction)。

A1 B0 G1 M1 X0 I0 A0 30

A0 B0 G0 M3 X0 I0 A0 30

or A1 B0 G1 M1+3 X0 I0 A0 ___

60

4) M10 - 3 ~ 4 個階段 (3 to 4 stages)

- ❑ 物体在 3 ~ 4 個方向或階段移動 (Object is displaced in 3 or 4 directions or increments)。

例如 (Examples)：

- ❑ 從空擋一步步轉換到 4 擋 (From neutral, shift through all gears of a "4-speed" transmission)。
- ❑ 打開 4 段的木工尺。可能有暫停和移動的動作，雖然不用控制 (Open carpenter's rule 4 lengths. May involve re-gasping and moves motion although control is not given up)。

3. 工時參數 (Process Time Parameter) - [X]

X - 工時 (Process time)

- ❑ 控制机器的時間，簡單的計時觀察及參考受控動作數据卡或續表數据卡，并選出當時的指標值 (For machine controlled time, simply clock an observation and refer to the controlled move data card or the extended values data card and select the proper index value)。

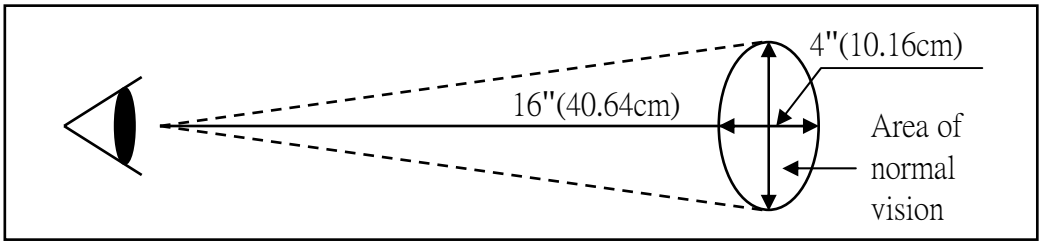
說明 (Note)：X 參數從不用實際計時 (Actual time clocked is never placed on the X parameter)。

- ❑ X 參數僅僅用在短暫，相對固定的過程時間。較長的机器時間必須考慮包括這個變量和建立順序表格 (The X parameter is to be used for short, relatively fixed process times onluy. Longer machine times must be covered by considering the variables and establishing separate tables)。

4. 對准參數 (Align Parameter) - [I]

1) I - 對准物体 (Align object)

- ❑ 人在距离 16 英寸之外單隻眼睛能看清直徑 4 英寸的范圍 (或者是 4 : 1 的比例；20 英寸能看到直徑是 5 英寸的范圍等) {At 16 inches away a single eye focus can cover an area of 4" (10.16cm) in diameter (or any ratio of 4 x 1; from 20" the area of normal vision is 5" (12.7cm), etc.)。

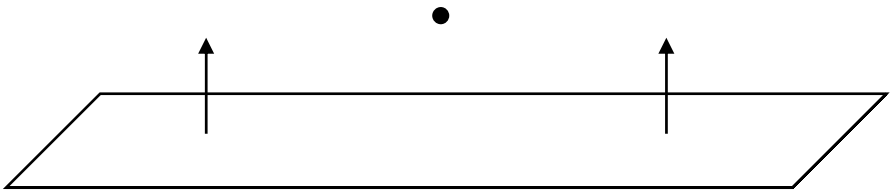


- 對准物体只适用于必須調整的受控動作 (The align objects values will only apply following the controlled move if additional adjustments are necessary.)。

a. I1 - 如果這個受控動作是一個物体去對准一點取 I1。這與一般動作的 P1 非常相似 (If following a controlled move, an object is a ligned to one point than an I1 will be given. This is very similar to the P1 following an action distance in a general move.)。

例如 (Examples)：

- 對准一個點 (Aligning to one point)。

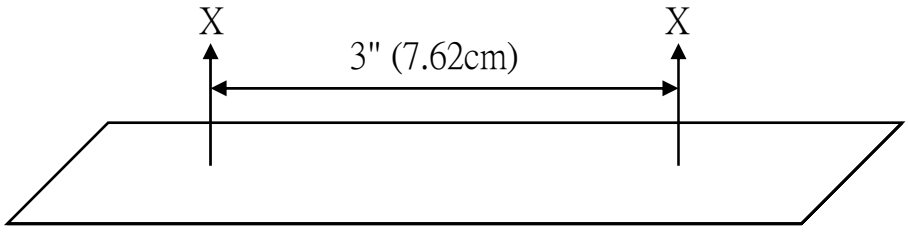


- 答案 (Answer)：I1

b. I3 - 如果這個受控動作是調整兩點間距并且使兩點在視線范圍內，輕松 地將物調整靠向兩點，沒有特別要求取 I3 {If following a controlled move, an alignment between two points is made and both points lie within the "area of normal vision", the alignment of an object to those two points can be performed easily without any special "eye times" (I3 would apply)}。

例如 (Examples)：

- 對准間距小于 4 英寸(10.16cm)的兩個點 (Aligning to 2 points less than 4" (10.16cm) apart)。
- 此例中 I 的取值是多少 (What is the "I" value for this alignment)?

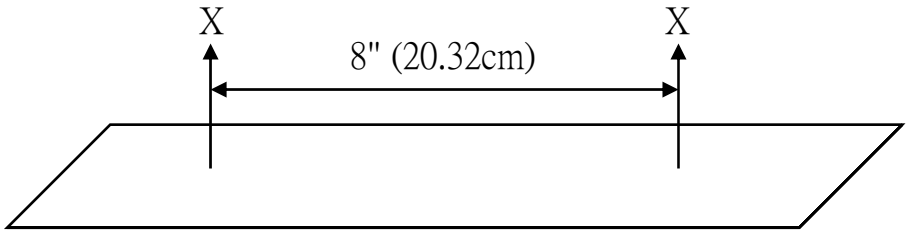


- ❑ 拿一把直尺并滑到兩點的位置划一條連接直線 (Place a ruler and slide it up to two points to draw a line)。
- ❑ 答案 (Answer)：I3

c. I6 - 如果一個物体對准的兩點間距超過 4 英寸(一點在視線內)，要看兩 次取 I6 (If an object is to be aligned to two points more than 4" (10.16cm) apart (one point is outside the "area of normal vision". 2 separate eye times occur and I6 would apply)。

例如 (Examples)：

- ❑ 兩點間距大于 4 英寸 (Aligning to 2 points > 4" apart)。



- ❑ 答案 (Answer)：I6

d. I16 - 精密 (Precision)

- ➢ 物体要用一個非常小心和精密的動作去對准 (The object is aligned with extreme care or precision following a controlled move)。

例如 (Examples)：

- ❑ 對准曲線 (Align french curve)。
- ❑ 對准模板 (Align drawing template)。

2) 机加工工具 (Machining Tool)

- ❑ 机加工工具的調整是運用手輪或曲柄來完成。只分析机加工工具的移動時，用下面的對准指標值。

a. I3 - 止塊間往返 (To / from stop / workpiece)

- ➢ 工具在切削前對准(靠住)擋塊或從擋塊回程接著切削 (The tool is aligned to a stop or workpiece before making the cut or retracted from a stop or the workpiece following the cut)。

b. I6 - 刻度間往返 (To / from scale mark)

- 工具在切削前對准一個刻度或從那某刻度回程接著切削 (The tool is aligned to a scale mark before making the cut or it is retracted from a scale mark following the cut)。

c. I10 - 對正 (To indicator dial)

- 運用手輪或曲柄將机加工工具對准刻度轉盤 (The machining tool is aligned to an indicator dial by manipulating a crank or a handwheel)。

5. 受控動作順序練習 (Controlled move excersises)

填充下面每個例子的順序并計算順序的時間，比較你的和老師的結果 (Fill out the sequence model following each example and calculate the sequence time in TMU. Compare your results with your trainer's solution)。

1) 從一部衝床前的一個位置，一個工人走 2 步抓住一個安全門的把手將它滑開 10 英寸 (25.4cm) {From a position in front of a punch press, the operator takes 2 steps to the side, grasps the handle of a safety gate and slides it open 10" (25.4cm)}。

A B G M X I A =_____TMU

2) 一個衝床操作工人橫跨 2 步并雙手同時按鈕，衝床運行 3 秒鐘 (A punch press operator sidesteps 2 steps and pushes two buttons simultaneously. The press completes its stroke in 3.0 seconds)。

A B G M X I A =_____TMU

3) 工人握住机器曲柄搖 3 圈(曲柄隨手可及) {A machine operator cranks the slide 3 revolutions (Crank handle is within reach)}。

A B G M X I A =_____TMU

4) 一個物料員走 3 步將一塊重的卡板放上滚筒，先滑動 8 英寸(20.32cm)然后推行 30 步到另一個地方 {A material handler takes 3 steps, takes contol of a heavy pallet on rollers, slides it 8" (20.32cm) to get clearance and then slides the pallet 30 feet to another area (Use walk data)}。

A B G M X I A

A B G M X I A

=_____TMU

5) 一個工人返身 2 步那到一件產品并小心地滑進行夾具對准距离 6 英寸。然后腳踏開關下行 4 英寸，机器運行 4.2 秒 (An operator turns 2 steps, gains control of a part, and carefully slides it into a fixture where the part is aligned to two points separated 6" (15.24cm). The operator then engages a foot pedal on the machine and depresses the foot pedal 4" (10.16cm) producing a process time of 4.2 seconds.)。

A B G M X I A

A B G M X I A

=_____TMU

6) 一個繪圖員將直尺滑行了 16 英寸去量兩個間距 7 英寸的點 {A draughtsman slides a straight edge 16" (40.64cm) and lines it with two marks that are 7" (17.78cm) apart. (The straight edge is within reach)}。

A B G M X I A =_____TMU

7) 一個工人走 3 步并用一點力去按扭開机 (An operator walks 3 steps to switch on a machine by pressing a push button with some pressure. What is the analysis)。

A B G M X I A =_____TMU

8) 一個工人隨手關閉鉸鏈蓋 (An operator closes a hinged cover within reach)。

A B G M X I A =_____TMU

9) 一個工人拿一塊小机芯用力插進一個密封的槽里并插到位 (An operator picks up a small PCB assembly and inserts it into tight fitting slot with pressure and slides it to stop with pressure. Show your analysis)。

A B G M X I A

A B G M X I A

=_____TMU

第六節：工具使用順序

1. 工具使用順序 {Tool Use Sequence (TUS)}

1) 工具使用順序是描述工具使用的一般動作和受控動作的組合 (A combination of general and controlled moves describing the actions performed with tools)。

2) 工具使用順序模式包括 5 個動作階段 (Sequence model – comprised of five activity phases)：

A B G	A B P	U	A B P	A
拿工具	放工具	用工具	將物体或工具放到一邊	返回
(Get tool)	(Put or place tool)	(Use tool)	(Aside object or tool)	(Return)

3) 工具使用參數 (Tool use parameters) - [U]：

a. F - 擰緊 (Fasten)

b. L - 松開 (Loosen)

c. C - 切 (Cut)

d. S - 表面處理 (Surface treat)

e. M - 檢測 (Measure)

f. R - 記錄 (Record)

g. T - 思考 (Think)

2. 擰緊、松開參數 (Fastening Loosening Parameter) - [F&L]

擰緊、松開是指用手指、手或工具机械性地裝配或拆解用釘子固定或繩系之物到另一個物体 {F (Fasten) / L (Loosen) refers to mechanically assembling one object to / from another with threaded fasteners or nails, using the fingers, hand or a tool.)。

這個數据是按人的執行分類而不是按工具的使用分類，因為工具有很多用途 (The data is classified by the body member performing the action and not by the tool used, because the tool can be used in many ways.)。

1) F / L - 手指動作 (Finger action)

- 手指動作是指手指移動并去轉動一個螺母，螺栓螺釘等，只是手指用小力緊固。特點是用拇指和食指旋轉一個物体 (Refer to the movement of the fingers and thumb to turn a nut, bolt, screw, etc., with light resistance and only to finger tightness. Characterized by rolling or spinning an object between the thumb and index finger.)。

- 不包括擰緊或松開的次數 (Does not include time for final tightening or initial loosening.)。
- 數据卡上的數据反映人体執行動作的次數 (The numbers on the data card reflect the number of actions performed by the body member.)。

2) F / L - 手腕動作 (Wrist action)

- 包括移動距离小于 6 英寸 (15.24cm) 的手的動作，包括以下動作 {(Covers a movement of the hand up to 6" (15.24cm).}：
  - 敲 (Tapping motion)。
  - 扭前臂轉動螺母或螺絲刀或棘輪工具 (Twisting about the axis of the forearms to turn a nut or screwdriver or ratchet tool.)。
  - 旋轉 (Rotating)。

3) F / L - 轉動 (Turn)

- 轉動或扭動，如用手、一把螺絲刀、一把棘輪扳手或一把 T 型扳手，轉動包括擰緊、松開的次數及手的位置變化(不是工具) {Turn, or twist, as in using the hand, a screwdriver, a ratchet wrench or a T-wrench. Turn does include time for final tightening and initial loosening. Turn does include the repositioning of the hand (not the tool).}。

4) F / L - 重新定位 (Reposition)

- 工具擰緊時屬于重新定位，手沒有重新定位 (Pertains to repositioning the tool on the fastener, not repositioning the hand.)。
- 重新定位不包括擰緊和松開的次數 (Repositioning does not include time for final tightening and initial loosening.)。

5) F / L - 敲 (Tap)

- 一個向前和退后的手腕動作 (A back and forth motion of the wrist.)。

6) F / L - 曲柄 / 旋轉 (Crank / rotate)

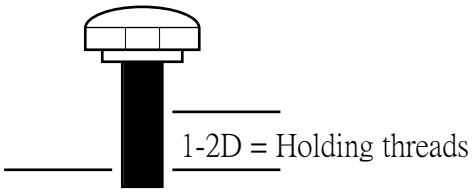
- 保持抓住這個工具使它旋轉或繞住固定物轉動的動作 (A motion where the tool is spun or “rotated” around a fastener while remaining affixed to it.)。
- 不包括手指擰緊或松開 (The value for crank / rotate does not include final tightening or initial loosening of the object)。

7) F / L - 手臂動作 (Arm actions)

- 包括移手指、手及手臂移動距离小于 18 英寸的動作。通常要求大的工具和力量 (Covers movement of the fingers, hand and arm up to 18” (45.72cm). Usually observed where larger tools and / or more power is required.)。
- 分類為 (Motion are also categorized by)：
  - 轉動 (Turn)
  - 重定位 (Reposition)
  - 旋轉 (Crank / rotate)
  - 擊打 (Strike)
  - 手臂動作的數据不包括擰緊和松開。包括其它所有手臂動作的時間 (The arm crank data does not include time for initial loosening or final tightening. All other arm actions do include time.)。

8) F / L - 電動工具 (Power tool)

- 電動工具 (電動扳手) - 數据建立決定于固定物的直徑，因為把握 固定物的螺紋數量要求等于固定物直徑的 1~2 倍，因此我們能計算把握物体需要的擰緊次數 (Power tool (power wrench) - the data is based on the diameter of the fastener, because the number of threads required to hold the fastener in place is equal to 1 to 2 times the diameter of the fastener. Therefore we can calculate the amount of time needed to “hold any item.)。



  - 選擇電動工具時你一定要知道固定物的直徑 (To use the power tool data you must know the diameter of the fastener.)。
  - F / L3 - 用于直徑小于或等于 0.25 英寸的固定物 {F / L3 - For fasteners up to and including 0.25" (0.635cm).}。
  - F / L6 - 用于直徑小于或等于 1 英寸的固定物 {F / L6 - For fasteners up to and including 1" (2.54cm).}。

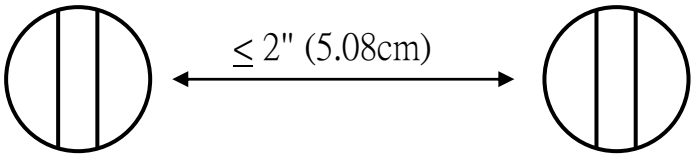
9) F / L - 使用工具(沒有手腕動作) {F / L – Tool use (No of wrist actions)}

- 例如: “用一個螺絲批，轉動 6 圈緊固一粒螺絲 " (Example: “Using a screwdriver, tighten a screw with 6 wrist actions.)。

  A1 B0 G1 A1 B0 P3 F16 A1 B0 P1 A0 = 240 TMU

10) F / L - 使用工具(間距小于 2 英寸) (F / L - Tool use - 2" and less apart)

- 例如: “用一個螺絲批，每個轉動 6 圈緊固兩個間距小于 2 英寸的螺絲 " {Example: “Using a screwdriver, tighten two screws with 6 wrist actions each. Distance between the screw is less than or equal to 2 inches (5.08cm).}

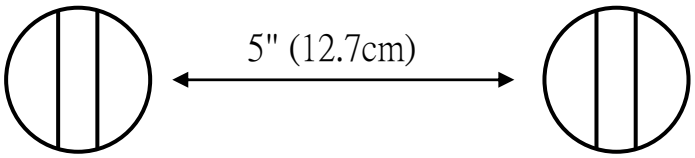


A1 B0 G1 A1 B0 (P3 A0 F16) A1 B0 P1 A0 (2) = 430 TMU

說明: 用工具時必須加“A " 表示兩個螺絲間是分開的 (Note: Must add “A” to the tool use section to account for the distance between the screws.)

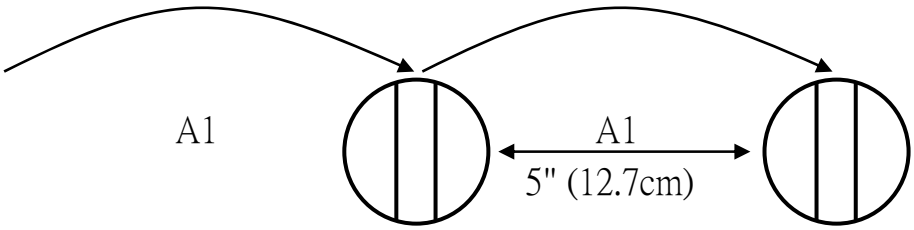
11) F / L - 使用工具(2 粒螺絲間距大于 2 英寸) {F / L - Tool use (2 screws > 2" apart)

- 用一個螺絲批，每個轉動 6 圈緊固兩個間距大于 2 英寸的螺絲 {Using a screwdriver, tighten two screws with 6 wrist actions each. Distance between the screw is 5 inches (12.7cm).}。



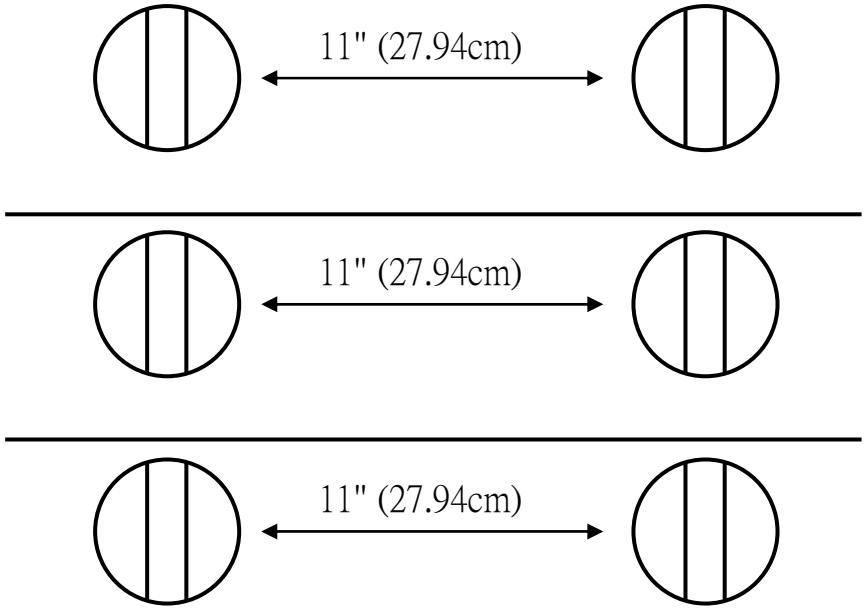
A1 B0 G1 A0 B0 (P3 A1 F16) A1 B0 P1 A0 (2) = 440 TMU

注意: 你必須降低“A " 的值，因為它包括在頻繁發生的動作里 (Watch out! You must drop the placement “A” value for it will be included in the frequency)。



12) F / L - 使用工具(2 個螺絲的間距大于 2 英寸) (F /L - Tool use 3 sets of 2 screws less > 2" apart)

- 例如: “一個操作，有三組兩粒螺絲間距 11 英寸用一個螺絲批每個轉動 6 圈緊固。這個操作者在每組螺絲緊固完后再拿螺絲并將螺絲放在一邊 (Example: “During an operation, three sets of two screws located 11" (27.94cm) apart are fastened with six wrist actions using a screwdriver. The operator will pick up and put aside the screwdriver after each set is tightened.)。



rf cf

A0 B0 G1 A0 B0 (P3 A1 F16) A1 B0 P1 A0 (2) 3 = 1320 TMU

- 每組擰 2 顆螺絲，共 3 組 (The entire operation of fastening two screws is performed three times)。
- 時間(Time): 20 x 2 = 40 + 4 = 44 x 3 = 132 x 10 = 1320 TMU

13) 复雜的工具動作 (Multiple tool actions)

- 當一個操作者用一件工具的時候可能用不同身体動作和工具動作 (An operator may use different tool actions and body member actions when using a single tool.)。

- 例如：一個螺母用手碗旋轉了 8 圈，跟著轉動一圈擰緊。我們寫出順序模式如下 (For example: A nut is turned 8 rounds with a wrist crank followed by 1 wrist turn to tighten. We would write the sequence model as follows)：

  A1 B0 G1 A1 B0 P3 F16+3 A1 B0 P1 A0 = 270 TMU

  - 當用同樣的工具有不同的動作時，我們就用這個程序。當擰緊或松開時大体上用到手指或手腕/手臂的旋轉 (You should only use this precedure when two different types of actions are performed with the same tool. This will mainly be with the use of finger actions or wrist / arm cranks when the final tightening or initial loosening is required.)。

14) P - 工具放置

- 工具放置包括整套工具或物体在工具動作前的位置 (Tool placement - covers the setting of the tool or object in the work position prior to tool action.)。
  - 手指(Fingers) - P1 {擰緊 P3，克服阻隔擰緊 P6 (P3 for placing fastener, P6 for placing fastener blind or obstructed)}
  - 螺絲批(Screwdriver) - P3
  - 鉗子(Pliers) - P1 (P3) {如果不要求位置取 P1 (If placement is to an exact location)
  - 剪刀(Scissors) - P1 (P3) {如果不要求位置取 P1 (If placement is to an exact location)
  - 棘輪工具(Ratchet) - P3
  - T-型扳手(T - Wrench) - P3
  - 扳手{Wrench (fixed end, box, allen)} - P3
  - 活動扳手(Adjustable wrnch) - P6 {緊固物体時手指要調 (Accounts for finger actions to adjust wrench)}
  - 錘子(Hammer) - P0 (如果第一次敲擊要對准取 P1 {P1 if aligned before the first stroke)}
  - 電動扳手(Power wrench) - P3
  - 檢測方法 (目的是檢測) {Measuring device (when the purpose is to measure) - P1
  - 書寫工具(Writing instrunment) - P1

- 表面處理方法(Surface treating device) - P1

3. 剪切參數 (Cut parameter) - [C]

1) C - 剪切是指用帶刃的工具分离，分開或去掉物体一部分的動作 (Cut - describes the manual actions to separate, divide, or remove part of an object using a sharp edge tool)。

a. C1 - 把握 (Grip / to hold)

- 用鉗口夾線 (To grip the wire in between the jaws of the pliers)。

b. C6 - 扭 (Twist)

- 拿一把鉗子放在兩根線上，鉗口夾住線頭將線扭在一起。如果多過兩條線就必須用 C6 (Following the placement of the pliers on two wires, the jaws are closed and two twisting motions of the pliers join the wires together. If more than two twisting motions are required, then a frequency must be applied to the C6.)。

例如：結合兩條線扭 6 圈 (Example: Join two wires together using 6 twisting actions.)。

A1 B0 G1 A1 B0 P1 (C6) A1 B0 P1 A0 (3) = 240 TMU

c. C6 - 彎環 (Bend loop)

- 彎成環時注視線頭 (This will occur if a loop or eye were needed at the end of the wire.)。

2) C - 鉗(線) {Pliers (Wire)}

- 用鉗子剪線基本上有 3 种方法剪切 3 种線 (This second column of the pliers data pertains to the cut off activities performed by pliers on wire. There are basically 3 types of wires requiring 3 methods of cutting.)。

a. C3 軟線 - 用一只手只剪一下 (C3 Soft - recognized by using the pliers with one hand and making one cut.)。

b. C6 适中 - 用一只手只剪兩下 (C6 Medium - recognized by using the pliers with one hand and making 2 cuts.)。

c. C10 堅硬 - 用兩只手只剪兩下 (C10 Hard - recognized by using 2 hands and making 2 cut.)。

3) C - 剪刀 (Scissors)

- ❑ 用來剪切類似紙、紡織品或薄紙板等材料的剪刀剪線。其剪切的數值取決於剪切的次數或動作 (The wire cutting activities performed by scissors will apply the cutting of paper, fabric, light cardbaoard, or similar materials. The index values are based on the number of cuts or scissors ations.)。

a. C1 - 剪一刀 (One cut such as cutting a piece of thread)

b. C3 - 剪兩刀 (Two cuts)

c. C6 - 剪 3~4 刀等 (3 to 4 cuts, etc.)

4) C - 剪布(5 刀) {Cut cloth (5 cuts)}

- ❑ 一個女裁縫用 5 刀剪開一塊布。

  A1 B0 G1 A1 B0 P1 C10 A1 B0 P1 A0 = 160 TMU

- ❑ 如果要對准取 P3 (If the placement was to be an exact mark, the would probably be a P3.)。

5) C - 小刀 (Knife)

- ❑ 小刀切的數据根据小刀切的次數。一刀切一行或紙板箱上一個切口 (The cutting with a knife data is based on the number of cuts. A cut can be merely cutting a string or a cut on a cardboard box.)。
- ❑ 也許要切多次，除非選好小刀。另外，P 值和 C 一樣必須有頻率 (Multiple strokes may be used unless the knife is picked up. Otherwise, the P value as well as the C must have frequencies.)。

🔔 **例如 (Example)：**

- ❑ 切卡通箱的 3 條邊 (Cut three sides of a corrugated box)。
- ❑ 隨手拿放 (Get and aside is reach)。

  A1 B0 G1 A1 B0 P1 C10 A1 B0 P1 A0 = 160 TMU

4. 表面處理參數 (Surface treatment parameter) - [S]

1) 表面處理是指除掉或涂在物体表面或一些位置的物質 (Surface treat refers to acitivities aimed at imporving the finish of an object by removing material from or applying a coating to a surface or location.) 。

- ❑ (放置前，表面處理參數值“S " 在工具使用順序里將出現 P1.) Placement prior to the “S” value in the tool use sequence will normally occur with a P1.
- ❑ 表格數据只是用于除去輕的物質 (Data in table is for removing light material only.)。

2) S - 用气壓清洁 (Are Clean)

- ❑ 用气管或風嘴吹小的晶体片，孔或腔体，單位用平方尺，一點或一個孔 (The activity is for blowing small particles or chips out of a hole or cavity or from a surface with an air hose or nozzle. The index values are based on square feet or a point or cavity.)。
- ❑ 如果用气壓去吹掃干淨一個表面，那么要計算區域面積并給予适當的指標值 (If the area being cleaned is a surface that will be cleaned with a sweeping action of the air, then the square footage of the area is calculated and the appropriate index value is assigned.)。

a. S - 用气壓清洁 3 平方尺或 0.3 平方米 {Air clean (3 FT^2) or (0.3 m^2)}

- ➢ 用气壓清理 3 平方尺。气管在隨手拿放的范圍內 (Clean 3 square feet with air. The air hose is within reach and asided within reach.)。

  A1 B0 G1 A1 B0 P1 S16 A1 B0 P1 A0 = 220 TMU

b. S - 清洁 4 個孔 {Air clean (4 cavities)

- ➢ 從 4 個孔里除去碎片，每個孔相距 6 英寸。气管在隨手拿放的范圍內 (Remove chips from 4 cavities, located 6" (15.24cm) apart. The hose is within reach and asided within reach.)。

  A1 B0 G1 A0 B0 (P1 A1 S6) A1 B0 P1 A0 (4) = 360 TMU

注意，這個動作的距离大于 2 英寸，因此括弧內應是 A1 (Note that the action is greater than 2" (50.8cm) so the A1 must be in parentheses.)。

3) S - 用刷子清洁 (Brush clean)

- ❑ 這個指標值決定于用刷子清洁的平方尺面積。用手抓住一個小的物体清掃是 S6 (The index value is based on the number of square feet being cleaned with a brush. A value of S6 is also used for brush cleaning a small object you can hold in one hand.)。

5. 測量參數 (Measurement Parameter) - [M]

1) M - 測量 (Measure)

- ❑ 一個物体物理特性和標准的比較 (Includes all actions utilized in the determination of a certain physical characteristic of an object by comparison with a standard measuring device.)。
  - ➢ 一般情況下，放置測量議器取 P1 (As a general rule, placement of a measuring device is a P1)。

🔔 **說明 (Notes)： M 參數包括必須的放，對准及檢查方法 (The "M" parameter covers all necessary actions to place, adjust and examine the device or object when using the following device.)。**

2) M10 - 輪廓測量 (Profile gauge)

- ❑ 用(角度、半徑、扭力)量器檢查物体的結构尺寸。

🔔 **例如 (Example)： 用量角器測量直角 (Right angle to measure "squareness of a corner".)。**

3) M16 - 刻度尺 (Fixed scale)

- ❑ 包括用直尺(12 英寸直尺，碼尺，米尺等)或量角器(分度器)等測量設備測量和讀數据 (Covers the use of linear, (12" ruler, yardstick, meter stick, etc.) or angular (protractor) measuring device whick includes positioning the tool and reading the actual dimension from a graduated scale.)。

4) M16 - 小于或等于 12 英寸的千分尺 {Calipers $\leq$ 12 omcjes (30.5cm)}

- ❑ 時間包括測和讀 (Includes time to set the calipers and read the dimension.)。

5) M24 - 塞規 (Feeler gauge)

- ❑ 包括展開量規，讀和選合适的規格，然后去(塞)測量間隙 (Includes fanning out the gauge, reading and selecting the appropriate blade size and positioning the blade to the gap to check for fit.)。

6) M32 - 6 英尺的鋼卷尺 (Steel tape, 6 feet (183cm)

- ❑ 包括拉卷尺，測量物体，讀數据和收回卷尺 (Includes pulling the tape from the reel, positioning and repositioning both ends of the tape, reading the dimension from the tape scale and finally pushing the tape back into the reel.)。

7) M32 / M42 / M54 - 4 英寸長的游標卡尺 {Micrometers, 4" (10.2cm)}

- ❑ 包括 3 种不同的測微計：測量深度(M32)、外徑(M42)、內徑(M54)。數据決定于測微計的最大尺寸(4 英寸)及測量、調整、鎖緊、讀數。(These three index values cover the use of three different micrometers for measuring depth (M32), outside diameter (M42) or inside diameter (M54). Data is based on micrometers with maximum dimensions of 4" (10.2cm) and include setting the "MIC" to the part, adjusting the thimble of fit, locking the device and reading the scale to determine the dimension.)。

8) 量 2 點間的距离 (Measure distance between 2)

例如 (Example)：用 12 英寸的直尺量兩點間的距离，直尺隨手可得 (A 12" ruler is used to measure the distance between two points; if the distances to pick up and aside the ruler are within reach, what time is allowed?)。

- ❑ 答案：

  A1 B0 G1 A1 B0 P1 M16 A1 B0 P1 A0 =220 TMU

6. 記錄參數 (Recording Parameter) - [R]

1) R - 記錄 (Record)

- ❑ 包括用寫或做記號的工具做記錄資料的動作 (Covers the manual actions performed with a writing instrument or marking tool for the prupose of recording information.)。

2) R - 寫 (Write)

- ❑ 拿鋼筆、鉛筆和其它書寫工具用正常的筆跡去寫。R 參數的選擇根据數字或字母的個數 (Applies to normal handwriting operations (normal freehand writing or printing) performed with a pen, pencil or other writing instrument. To cover the routine clerical activities encountered in many jobs, such as filling out time card, writing a part number, filling in a quantity etc. Index values for these "R" parameters are selected primarily on the basis of the number of "Digits" (letter or numerals) or the number of "words" written.)。
  - ➢ 簽名(兩個詞)或日期(7-4-99 或 July 4, 1999)是 R16 {For writing one's signature or date (either 7-4-99 or July 4, 1999) as two words and assigning an R16.}

3) R - 標記 (Mark)

- ❑ 用印記工具(划線器，波仔，噴霧器等)在物体上做記號 (Covers the use of such marking tools as a scribe, felt marker, spray can, etc., for the purpose of identifying or marking a mark on an object.)。
- ❑ 打印 1~3 英寸內的數字符。一個檢查標記是 R1，一個記錄標記是 R3 ("Digit" applies to printed characters (letters and numerals) of 1" (2.54cm) to 3" (7.62cm) in size. A check mark is an R1 and a scribe mark is an R3)。

7. 檢查參數 (Think) - [T]

1) T - 考慮 (Think)

- ❑ 指用腦力 (Refers to the use of mental process)
  - ➢ 包括特別的視覺動作如檢查、審查、辨別 (Particularly those involving visual perception such as inspect, examine or read.)。

2) T - 檢查 (Inspect point)

- ❑ 決定于被檢查點的數量 (The index values in the inspect point column are determined by the number of points being inspected)。
- ❑ 只是用“是 " 或“不是 " 确定缺陷是否存在 (For each point a simple Yes or No decision is made concerning the presence or absence of defects.)。

3) T - 檢查四點 {Inspect (4 points)}

- ❑ 檢查一塊電路板上的 4 點。這塊電路板隨手可以拿放 (Inspect a printed circuit at 4 points. The circuit board is within reach and is asided within.)。

  A1 B0 G1 A1 B0 P0 T6 A1 B0 P1 A0 =110 TMU

🔔 **說明：T6 前的 P0，如果板是在反光鏡、燈光或夾具中檢查則用 P1 或更高 (Note: The P0 value before the P6 could be P1 or higher if the board was located under a mirror, under a light or into a fixture for inspection.)。**

4) T - 文字 (Text of words)

- ❑ 讀句子或段落，工作單，或藍圖的文字，根据詞語的個數來選擇指標值 (These values will be used for reading sentences or paragraphs, shop orders, or text on a blueprint. The index value is determined by counting the number of words and choosing the appropriate valure.)。

5) T - 數字或單詞 (Digits or single words)

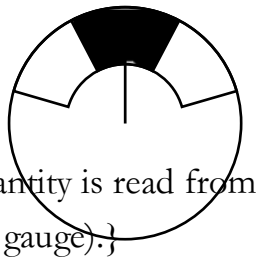
- 用來讀技術數据如物料編號，訂單數量編碼等。一個讀數可以是一個數字，一個字母或一個特殊的字符 (This is to be used for reading technical data such as part numbers, order quantities codes etc. A digit can be a number, a letter, or a special character.)。

例如：讀“Q " 是 T1。讀“789 " 是 T3(3 個數字。讀單詞“adjust " 是 T1(1 個單詞) {Example: To read the letter “Q” would be T1. To read the number “789” would be T3 (3 digits). To read the word “adjust” would be a T1 (one word)}。

6) T - 讀 (Additional values for specific reading activities)

a. T3 - 測量 (Gauge)

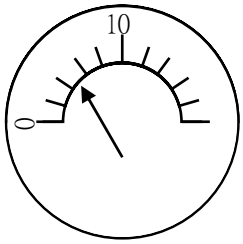
- 檢查打印机的速度 (The gauge is checked to see that the printer is within a clearly marked tolerance range.)。
- 根据計算打印詞句的數量選擇指標值 (The index value is determined by counting the number of words and choosing the appropriate value.)。



b. T6 - 刻度值 (Scale value)

- 讀体溫計{A specific quantity is read from a graduated scale such as a temperature gauge (draw gauge).}

Example: Read approximately 25 psi.



c. T6 - 日期 (Date / Time)

- 年年-月月-日日 ({his value is for reading the date (month, day, year) from a document or calendar; the time is read from the clock or wrist watch.}。

d. T6 - Touch for heat (触摸)

- 用手触摸物体然后移開 (The hand moves to the object, over the object and removed.)。

e. T10 - Feel for defect (感覺缺陷)

- 用手摸三個面后移開 (The hand is moved to the object, moves over 3 surfaces and removed.)。

f. T10 - 讀游標刻度 (Vernier scale)

- 數据卡上的值是從測微器，測徑器或類似的設備讀得的 (The value that appears on your data card is to visually locate and read (only) an exact value from a micrometer, caliper or similar device.)。
- 不包含儀器的放置時間和調校儀器的時間 (Does not contain time for placing and setting the device to an object.)。
- 讀游標的刻度 (An example would be merely pick up a vernier and read the scale.)。

g. T16 - 表格值 (Table values)

- 一些特殊值要從表格里尋找和讀取 (A specific value is located and read from a table such as the correct machine setting from a feed / speed table.)。

8. 使用工具順序練習 (Tool use exercises)

填充下面每個例子的順序并計算順序的時間 **(Fill out the sequence model following each example and calculate time in TMU.)**。

1) 拿一把 12 英寸的扳手每次轉動 5 圈，擰緊 4 顆分別相距 6 英寸(15.24cm)的螺栓，用手臂的動作，然后將扳手放在一邊 (Obtain 12" (30.48cm) wrench within reach and run down four (4) bolts, located 6" (15.24cm) apart, 5 turns each. Use arm actions and aside tool within reach.)。

A B G A B P (A F) A B P A =_____TMU

2) 拿螺絲批每次轉動 5 圈，擰緊 4 顆分別相距 1 英寸(2.54cm)的螺絲后放下工具 (Obtain screwdriver within reach, run down four (4) screws, located 1" (2.54cm), 5 wrists turn each and aside tool within reach.)。

A B G A B P (A F) A B P A =_____TMU

3) 走兩步到一個工具箱前很容易地拿一把 1/4 " 的棘輪扳手，返回工位，每次 5 圈擰松 4 顆相距 6 英寸 (15.24cm)的螺栓后放下工具 (Walk 2 steps to

a tool box and obtain a 1/4" (6.35mm) drive ratchet, not tangled. Return to work place and loosen four (4) bolts, located 6" (15.24cm) apart, 5 wrist turns each and aside tool within reach.)。

A B G A B P (A F) A B P A =_____TMU

4) 在一項裝配操作中，一個工人伸手從物料盤拿 4 顆螺母，用手指每次 5 圈擰到 4 顆相距 6 英寸(15.24cm)的螺栓上，這個裝配做 3 次，每次之間走 2 步 (Three (3) times during an assembly operation a worker obtains four (4) nuts from a part bin located within reach. He fastens them to bolts located 6" (15.24cm) apart with 5 turns each using his fingers. The walking distance is 2 steps in both directions.)。

A B G A B P (A F) A B P A =_____TMU

5) 用手指松開 4 顆螺母，每次松 5 圈，松完后，將 4 顆螺母一起放到一邊 (With the fingers, remove four (4) nuts from bolts located 6" (15.24cm) apart requiring 5 turns each, then aside all four (4) nuts at the same time.)。

A B G A B P (A F) A B P A =_____TMU

6) 一個作業員伸手拿一張工作卡讀上面的指令(45 個字)，之后走 3 步放到一個深 10 厘米的柜筒里稍做調整 (An operator gets a job card (within reach), reads the instructions (45 words) and aside the card (3 steps) into a rack hole of 10cm, with one adjustment.)。

A B G A B P (A F) A B P A =_____TMU

7) 伸手拿一把用鉗子從一個精准的地方取一件物品，然后將工具放到一邊 (With pliers (within reach) the operator grips a part at an exact location and aside tool within reach.)。

A B G A B P (C) A B P A =_____TMU

8) 一個木匠從 6 英尺外拿一把 T 形尺，返回并檢查一個方形木板箱，然后將 T 形尺放在一邊 (A carpenter gets a T-square from 6 feet (1.83cm) away, returns and checks the squareness of a crate. He then asides the T-square within reach.)。

A B G A B P (C) A B P A =_____TMU

9. 案例分析：用電梯搬運貨物 (Case study: Move objects using elevator)

這個實驗將給你們更多有關普通動作和受控動作實踐，并學習使用“標准時間分析表＂(This laboratory exercise will give you additional practice with General and Controlled Moves and allow you to use the "Standard Time Analysis Sheet".)。

1) 動作 (Activites)

a. 彎腰從地上拿一個皮箱, 穿著一道關著的門 (Pick up a briefcase from the floor, within reach after bending. Pass through a closed door and walk to the elevator.)。

b. 按電梯按鈕 (Press button to activate elevator.)。

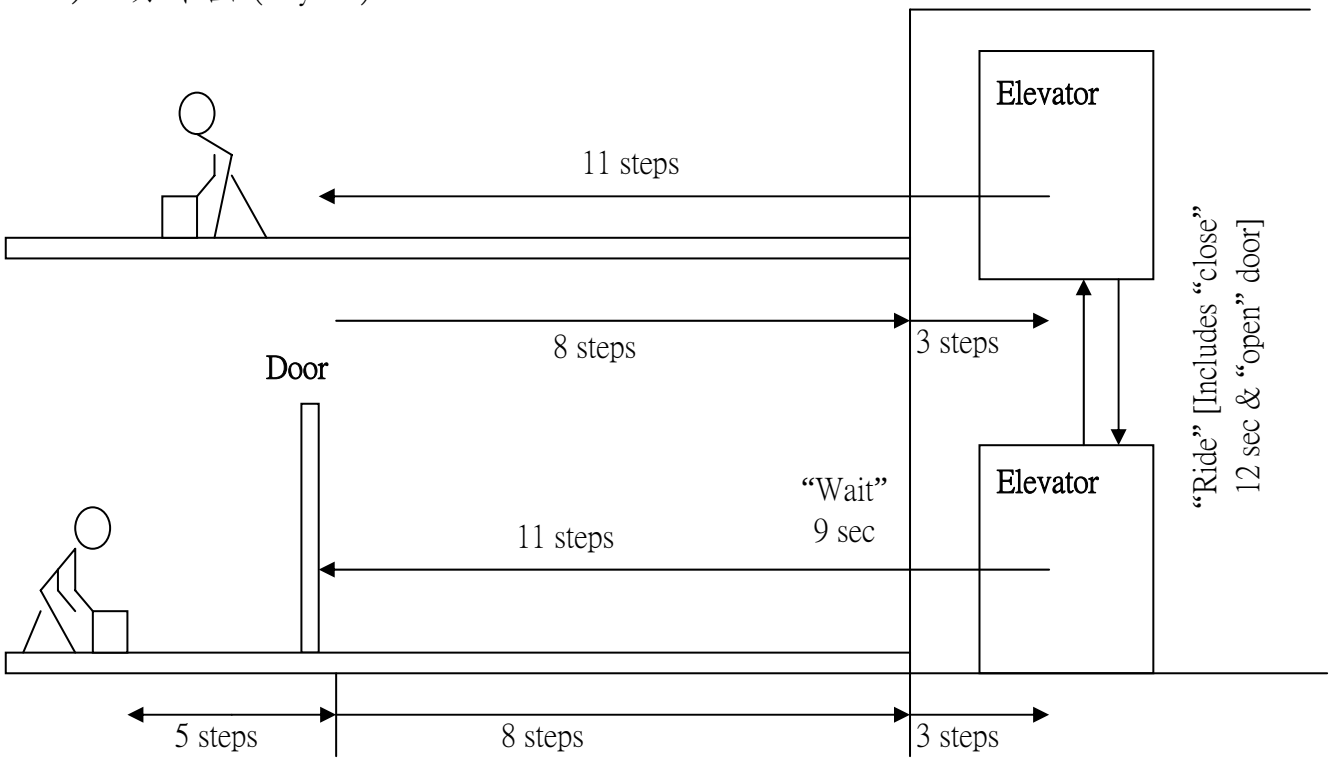
c. 上電梯并選擇想到的樓層 (Step on elevator and select desired floor.)。

d. 電梯運行 (Ride up the elevator.)。

e. 走出電梯將皮箱放在地上 (Walk and place briefcase on the floor.)。

f. 返回原位 (Return to initial position.)。

2) 分布圖 (Layout)



第七節：同時動作

1. 同時動作用(Simultaneous Motions)

有些動作在同一時間內可以由不同的身体部位執行 (These are motions that can be performed concurrently by separate body members within the same time.)。

同時動作時，較慢的動作限制較快的動作 (In SIMO motions, the longer motion will limit out he shorter motion.)。

2. 影響同時動作情況的因素 (Factors Affecting The Conditions For SIMO motions)

1) 時机 (Practice opportunity)

- 時机決定于 (This is determined by)：
  - 動作的類型 (Type of activity)
  - 生產的數量 (Volume of production)
  - 經驗判斷 (Trials of experience)

2) 困難的程度 (Degree of Diffeculty)

3) 視覺范圍 (Area of vision)

3. 方法水平和同時動作 (Methods Levels And SIMO Motions)

1) 高水平方法 (High method level)

- 包括所有可能同時用左右手的動作，算被限制手的(最長)時間，另一只手的時間在內 (Includes all possible simultaneous motions with the right and left hands. The time for the limiting (longest) hand is allowed; the other is "circled", limited out.)。

例如 (For example)：

STANDARD TIME ANALYSIS SHEET(High method level)
DIV/DEPT:
MODEL:
OS NO:
PROCESS: Nailing process
ST per pc:

No	Description	M/C Time	LM	RM		rf	cf	TMU	82BST (sec)	M/C Time (sec)	100BST (sec)
1	Get nail & place on wood		X		A1 B0 G1 A1 B0 P1 A0			40.0	1.4400		1.1808
2	Get hammer top on nail 3 times aside hammer			x	[A1 B0 G1] A1 B0 P1 F3 A1 B0 P1 A0			70.0	2.5200		2.0664
3	Aside wood to next process		x		[A1 B0 G1] A1 B0 P1 A0			20.0	0.7200		0.5904
4								0.0	0.0000		0.0000
5								0.0	0.0000		0.0000
6								0.0	0.0000		0.0000
7								0.0	0.0000		0.0000

	Time per pc (sec) Time per pc (sec) (include M/C time) Time per pc (min)							130.0	4.6800 4.6800 0.0780	0.0000	3.8376 3.8376 0.0640

2) 低水平方法

- ❑ 不同時動作,必須做雙手的時間分析 (Involves no simultaneous motions. The analysis time for both hands must be allowed.

🔔 例如 (For example):

STANDARD TIME ANALYSIS SHEET(Low method level)
DIV/DEPT:
MODEL:
OS NO:
PROCESS: Nailing process
ST per pc:

No	Description	M/C Time	LM	RM		rf	cf	TMU	82BST (sec)	M/C Time (sec)	100BST (sec)
1	Get nail & place on wood		X		A1 B0 G1 A1 B0 P1 A0			40.0	1.4400		1.1808
2	Get hammer top on nail 3 times aside hammer			x	A1 B0 G1 A1 B0 P1 F3 A1 B0 P1 A0			90.0	3.2400		2.6568
3	Aside wood to next process		x		A1 B0 G1 A1 B0 P1 A0			30.0	1.0800		0.8856
4								0.0	0.0000		0.0000
5								0.0	0.0000		0.0000
6								0.0	0.0000		0.0000
7								0.0	0.0000		0.0000
	Time per pc (sec) Time per pc (sec) (include M/C time) Time per pc (min)							160.0	5.7600 5.7600 0.0960	0.0000	4.7232 4.7232 0.0787

3) 中等水平方法

- ❑ 一部分同時動作 (Method is performed partially with SIMO motions.)

🔔 例如 (For example):

STANDARD TIME ANALYSIS SHEET(Intermediate method level)
DIV/DEPT:
MODEL:
OS NO:
PROCESS: Nailing process
ST per pc:

No	Description	M/C Time	LM	RM		rf	cf	TMU	82BST (sec)	M/C Time (sec)	100BST (sec)
1	Get nail & place on wood		X		A1 B0 G1 A1 B0 P1 A0			40.0	1.4400		1.1808
2	Get hammer top on nail 3 times aside hammer			x	A1 B0 G1 A1 B0 P1 F3 A1 B0 P1 A0			90.0	3.2400		2.6568

3	Aside wood to next process		x		[A1 B0 G1] A1 B0 P1 A0			20.0	0.7200		0.5904
4								0.0	0.0000		0.0000
5								0.0	0.0000		0.0000
6								0.0	0.0000		0.0000
7								0.0	0.0000		0.0000
	Time per pc (sec) Time per pc (sec) (include M/C time) Time per pc (min)							150.0	5.4000 5.4000 0.0900	0.0000	4.4280 4.4280 0.0738

4. 同時動作表 (SIMO Table for gain control)

Method \ Method	容易(East)	困難(Difficult)
容易(East)	任何時間 (SIMO at all time)	有時 (SIMO) only with practice opportuniy)
困難(Difficult)	有時 (SIMO only with practice opportunity)	沒有 (Non-SIMO)

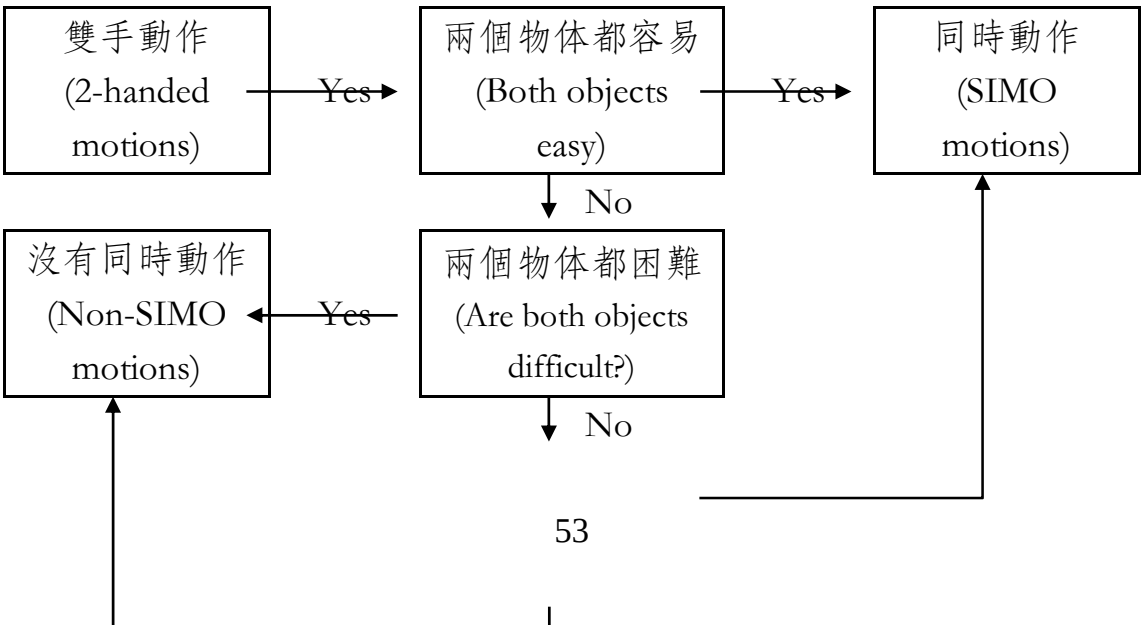
G1 - 同時拿輕物体 (Light object SIMO)

- ❑ 雙手同時獲得 2 個物体 (Gain control of 2 objects simultaneously - both hands.)

🔔 例如 (E.g.)

	左手 (LH)	右手 (RH)
1	錘子 (Hammer)	釘子 (Nail)
2	墊圈 (Washer)	螺栓 (Bolt)

5. 決定同時/不同時動作的圖表



有時 (Are there practice opportunity?)	Yes
No	

第八節：應用 (APPLICATION)

1. 什么是百分之百的執行標准 (What Is 100% Performance Standard)?

4MPH — 100 BSI ← 超水平 (Motivated performance level)

82 BSI ← 熟練水平 {Work performance level of a qualified operator (Trained & with practice opportunity)}

3MPH — 75 BSI ← 正常水平 (Normal performance level)

0

2. 時間測量單位 (Time Measurement Unit) - [TMU]

1 TMU = 0.00001 hr = 0.0006 min = 0.036 sec

3. 標准時間分析的基本步驟 (Basic Steps For Standard Time Analysis)

1) 建立完成工作最有效的方法。這是你的目的 (Establish the most effective method for accomplishing the task. This gives starting point for your analysis.)。

2) 收集有關的實際資料、數据 (例如：工場布局，設備，材料，車間條件等) {Gather and document the facts concerning the job (i.e., work place layout, tools, equipment, materials,shop conditions, etc.) and document them.}。

3) Use sequence models to give quantitative description of distances, types of placing activities, etc. They are indicators of possible method improvements - more production with less work time and effort.

4. 方法改善的一般規定 (General Rule For Methods Improvement)

1) All index values above 3 - investigate for methods improvement.

2) Tool use sequence - choose better tool if indicated and available.

5. 更新標准的指引 (Guideline For Updating Standard)

用原始“標准時間分析表＂和重新整理好分析表歸類成數据庫檔案 (Using the original “Standard Time Analysis Sheet＂ and retype or rewrite on clean Analysis Sheet and file in the data-bank. You will only change those individual index numbers that reflect the new method; there is no need to “write from scratch＂ a new “Standard Time Analysis＂.)。

6. 工作測量工具的好處 (Advantages Of This Work Measurement Tool)

1) 100% performance level at 82 BSI

2) Multi-level: Provides for analyses on 3 levels

3) Eliminates performance rating

4) Permits easy development of standards.

5) Considers changes in methods.

九節：標准時間分析數据表 (STANDARD TIME ANANLYSIS DATA SHEET)

1. 標准時間分析數据表一 (Standard time analysis data sheet 1)

ABG ABP A GENERAL MOVE / 普通動作

Index 序號	A	B	G	P	Index 序號
	Action distance 行程	Body motion 身体動作	Gain control 控制范圍	Place 放置	
0	≤ 2 inches ≤ 2 英寸 ≤ 5 cm ≤ 5 厘米			Hold 挾 Toss, Strike 搖，敲	0
1	Within reach 隨手范圍		Light object grip 抓小物件 Light object SIMO 同時抓取	Lay aside, Place 放一旁，放置 Loose fit (LF) 寬松	1
3	1 – 2 steps 1 – 2 步	Bend and arise 50% occur 彎下或直上 50%發生	Non SIMO 不需同時 Heavy or bulky 粗重 Blind or obstructed 阻隔 Disengage 釋放 Interlocked 連鎖 Collect 收集	Adjustments 調整 Light presure 微壓 Joggle, LF with intemediate moves 微量輕震調松	3

ABG MXI A CONTROLLED MOVE / 控制動作

Index 序號	M		X			I	Index 序號
	Move controlled 移動控制		Process time 工時			Align 對准	
	Push/Pull/Pivot 壓 / 拉 / 旋轉	Crank (Revs) 曲柄 (旋轉)	Secs 秒	Mins 分鍾	Hours 小時	Object 物件	
1	≤ 12" (30cm) Button/Switch/Knob ≤ 12 英寸 (30 厘米) 按扭 / 開關 / 把手(旋鈕)		0.5	0.01	0.0001	To one point 到某一點	1
3	> 12 inches (30cm) resistance seat or unseat > 12 英寸(30 厘米) 抵抗阻力 High control 2 stages ≤ 12" (30cm) 精确控制 2 段 ≤ 12 英寸(30 厘米)	1	1.5	0.02	0.004	To 2 points ≤ 4" (10cm) 到某兩點 ≤ 4 英寸(10 厘米)	3

6	3 – 4 steps 3 – 4 步	Bend and arise 彎下或直上		Care or precision 仔細或精密 Heavy pressure 重壓 Blind or obstructed 阻隔 Search & select 挑選	6
10	5 – 7 steps 5 – 7 步	Sit or stand 坐或站			10
16	8 – 10 steps 8 – 10 步	Through door 穿過門 Climb on or off 爬上或爬下			16

6	2 stages > 12 inches (30cm) 2 段 > 12 英寸(30 厘米)	3	2.5	0.04	0.0007	To 2 points > 4 inches (10cm) 到某兩點 > 4 英寸(10 厘米)	6
10	3 – 4 stages 3 – 4 段	6	4.5	0.07	0.0012		10
16		11	7.0	0.11	0.0019	Precision 精密	16

2. 標准時間分析數据表二 (Standard time analysis data sheet 2)

TOOL USE (FASTEN / LOOSEN) / 工具使用(鎖或松開)											
ABG ABP U ABP A											
Index 序號	Fasten or Loosen / 鎖或松開										Index 序號
	Finger Action 手指動力	Wrist action 手腕動作				Arm action 手臂動作				Power tool 電動力工具	
	Sprins 螺旋	Turn 旋轉	Reposition 重定位	Crank 曲柄	Tap. 攻牙	Turn 旋轉	Reposition 重定位	Crank 曲柄	Strike 敲	Screw Dia. 螺絲直徑	
	Fingers 手指 Screw-drver 螺絲刀	Hand 手 Screw-drver 螺絲刀 Ratchet 棘輪 T-Wrench T 型扳手	Wrench 扳手 Allen key 內六角扳手	Wrench 扳手 Allen key 內六角扳手 Ratchet 棘輪	Hand 手 Hammer 錘子	Ratchet 棘輪 T-Wrench T 型扳手	Wrench 扳手 Allen key 內六角扳手	Wrench 扳手 Allen key 內六角扳手 Ratchet 棘輪	Hand 手 Hammer 錘子	Power wrench 電動扳手 Screw 螺絲 Dia. 直徑 Inches 英寸	
1											
3											
6											

EXTENDED VALUES / 續表							
Action distance / 行程				Process time (X) / 工時 (X)			
Index 序號	Steps 范圍	Distance (Ft) 距离 (英尺)	Distance (M) 距离 (米)	Index 序號	Seconds 秒	Minutes 分鍾	Hours 小時
24	11-15	38	12	1	0.5	0.01	0.0001
32	16-20	50	15	3	1.5	0.02	0.0004
42	21-26	65	20	6	2.5	0.04	0.0007
54	27-33	83	25	10	4.5	0.07	0.0012
67	34-40	100	30	16	7.0	0.11	0.0019
81	41-49	123	38	24	9.5	0.16	0.0027
96	50-57	143	44	32	13.0	0.21	0.0036
113	58-67	168	51	42	17.0	0.28	0.0047
131	68-78	195	59	54	21.5	0.36	0.0060
152	79-90	225	69	67	26.0	0.44	0.0073

10											
16											
24											
32											
42											
54											

EXTENDED VALUES / 續表										
Crank / 曲柄	Index / 序號	M1	M3	M6	M10	M16	M24	M32	M42	M54
	Revs. / 旋轉	-	1	3	6	11	16	21	28	36

173	91-102	255	78	81	31.5	0.52	0.0088
196	103-115	288	88	96	37.5	0.62	0.0104
220	116-128	320	98	113	43.5	0.72	0.0121
245	129-142	355	108	131	50.5	0.84	0.0141
270	143-158	395	120	152	58.0	0.97	0.0162
300	159-174	435	133	173	66.0	1.10	0.0184
330	175-191	478	146	196	74.5	1.24	0.0207
				220	83.5	1.39	0.0232
				245	92.5	1.54	0.0257
				270	102.0	1.70	0.0284

3. 標准時間分析數据表三 (Standard time analysis data sheet 3)

ABG ABP U ABP A TOOL USE / 工具使用

Index 序號	C				S			M		R			T			Index 序號
	Grip etc. 抓	Cutoff 剪斷	Cut 剪	Slice 切片	Air-clean 噴气使清洁	Brush clean 刷	Wipe 抹	Measure 檢測		Wirte 寫		Mark 記號	Inspect 檢查	Read 讀		
	Pliers 鉗子		Scissors 剪刀	Knife 刀	Nozzle 气槍	Brush 刷子	Cloth 布	Measuring device 檢測設備		Pencil 鉛筆		Marker 記號筆	Eyes/Fingers 眼睛 / 手指	Eyes 眼睛		
		(Wire) (線)	Cuts 剪	Strokes 次數	Sq Ft $0.1M^2$ 平方英尺 0.1 平方米	Sq Ft $0.1M^2$ 平方英尺 0.1 平方米	Sq Ft $0.1M^2$ 平方英尺 0.1 平方米	Inch (cm) 英寸(厘米)	Ft (m) 英尺(米)	Digits 數字	Words 字母	Digits 數字	Points 點	Digit single words 個數	Text of words 文數	
1	Grip 抓		1	-	-	-	-			1	-	Check mark 查檢記號	1	1	3	1
3	1 Twist 扭轉 1 次	Soft 軟	2	1	-	-	0.50			2	-	1 Scribe line 1 划線	3	3 Gauge 測規	8	3

6	2 Twists Bend loop 扭轉 2 次彎曲成環	Medium 中等	4		1 Point or cavity 1 點或洞	1 Small object 一個小工件	-		4	1	2	5 Touch for heat 5 熱度手檢	6	15 Scale value (Date/Line) 刻度值(日期 / 線)	6
10		Hard 硬	7	3	-	-	1	Profile-gauge 成形規	6	-	3	9 Feel for defect 9 尋找缺陷	12	24 Vermier scale 游標尺刻度	10
16	Cotter-pin 栓子		11	4	3	2	2	Fixed-scale caliper Caliper 12 inches (30cm) 測徑器 測量 12 英寸(30 厘米)	9	2 Signature date 簽名日期	5			38 Table value 表格數值	16
24			15	6	4	3	-	Feeler gauge 測隙規	13	3	7			54	24
32			20	9	7	5	5	Steel-tape 6Ft (2m) Depth micrometer 六英尺鋼卷尺(2 米) 深度千分尺	18	4	10			72	32
42			27	11	10	7	7	OD-Micrometer 4 in (10cm) 外徑千分尺四英寸(10 厘米)	23	5	13			94	42
54			33					ID-Micrometer 4 in (10cm) 內徑千分尺四英寸(10 厘米)	29	7	16			119	54

第十節： PRACTICAL SESSION

STANDARD TIME ANALYSIS SHEET

DIV / DEPT: _____

MODEL: _____

OS NO: _____

PROCESS: _____

ST PER PC: _____

NO	DESCRIPTION	M / C TIME	USE		MOST SEQUENCE	rf	cf	TMU	MOST (sec)	M / C TIME (sec)	Sony SST (sec)
			LH	RH							
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
	Time per pc (sec) Time per pc (sec) (Include M/C Time) Time per pc (min)										