

## 添付資料 - 2 国家安全要件

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# 電力設備に関する国家安全要件

## パート I 総則

### 第 1 章 目的

#### 第 1 条: 目的

下記の目的のために、法規により電力安全に関する技術的要件を定める。

1. 感電、火災等の防止  
感電・火災を防止する為の電路の施設、電気設備の接地等を規定する。
2. 異常の予防及び保護対策  
電力設備における異常の予防と対策の基本的な考え方を規定する。
3. 電氣的、磁氣的障害の防止  
電気設備の電氣的、磁氣的な障害を生じさせない事を規定する。
4. 供給支障の防止  
電気設備の損壊により電力供給に支障を及ぼしてはならない事を規定する。
5. 第 1 項から第 4 項までを満たす電力供給のための設備の施設  
電力設備の保安の原則を踏まえ、電力設備の種類に応じた設備保安の為の技術要件を規定する。

国家安全要件は安全電力設備形成のための基本的な概念的規則を示すものである。この国家安全要件を遵守した上で、電力設備は詳細な設備形成の技術基準である SNI (PUIL を含む)、IEC 等、それらに準ずるガイドラインに基づき、形成・維持される。

### 第 2 章 範囲

#### 第 2 条: 範囲

本決定は、電力供給事業活動すべてに適用される。但し、原子力発電施設、風力発電施設、太陽光発電施設、第 57 条 (適用範囲) に含まれない水力発電施設、及び第 85 条 (適用範囲) に含まれない火力発電施設を除く。

## 第3章 定義

### 第3条：用語の定義

1. PUIL2000：インドネシアにおける電力設備の設置に関する強制規格である。
2. 変電所：構外からの電気を構内に設置した変圧器、回轉變流機、整流器その他の機器を用いて変成し、構外に電送する所をいう。
3. 発電所：発電機、電動機その他の機器を設置して電気を発生する所をいう。  
通信線：通信のために使う電線であり、光ファイバーケーブルを含む。

### 第4条：電圧の種別

電圧は、次の区分により低圧、中圧、高圧及び特別高圧の4種とする。

- 1) 低圧は1千ボルト以下のもの。
- 2) 中圧は1千ボルトを超え、2万ボルト以下のもの。
- 3) 高圧は2万ボルトを超え、23万ボルト以下のもの。
- 4) 特別高圧は23万ボルトを超えるもの。

## 第4章 保安原則

### ～ 感電、火災等の防止 ～

#### 第5条：電気設備における感電、火災等の防止

電気設備は、感電、火災、その他人体に危害を及ぼし、又は物件に損傷を与えないように施設しなければならない。

#### 第6条：電路の絶縁

1. 電路は、大地から絶縁しなければならない。絶縁抵抗値は、PUIL2000に従う。
2. 電路は、使用電圧に対して、事故時に想定される異常電圧を考慮し、十分な絶縁強度を持つものとする。
3. 電力量の計量や保護装置のために施設する変圧変流器内の巻線間の絶縁性能は、事故時に想定される異常電圧を考慮し、絶縁破壊による危険のおそれがないようにしなければならない。



## 第7条： 電線等の断線の防止

電線（電力線、支線、架空地線、通信線他）は、通常の使用状態において、断線のおそれがないように施設しなければならない。

## 第8条： 電線の接続

電線を接続する場合は、

1. 接続部分において、電線の電気抵抗を増加させないように接続する。
2. 絶縁性能の低下及び通常の使用状態において断線のおそれがないようにする。

## 第9条： 電気機械器具の熱的強度

電路に施設する電気機械器具は、通常の使用状態において、その電気機械器具に発生する熱に耐えるものでなければならない。

## 第10条： 中圧、高圧又は特別高圧の電気機械器具の危険の防止

1. 中圧、高圧又は特別高圧。の電気機械器具は、取扱者以外のものが容易に触れる恐れがないように施設しなければならない。
2. 中圧、高圧又は特別高圧の開閉器、遮断器、避雷器その他これらに類する器具であって、動作時アークを生ずるものは、火災の恐れがないよう、木製の壁又は天井その他可燃性の物から離して施設しなければならない。耐火性の物で両者の間を隔離した場合は、この限りではない。

## 第11条： 電気設備の接地

電気設備の必要な箇所には、異常時の電位上昇などによる感電、火災その他人体に危害を及ぼし、又は物件に損傷を与える恐れがないよう、接地その他適切な措置を講じなければならない。

## 第12条： 電気設備の接地の方法

電気設備に接地を施す場合は、電流が安全かつ確実に大地に通ずることができるようにしなければならない。

～ 異常の予防及び保護対策 ～

**第 13 条： 特別高圧側の電路等と結合する変圧器等の火災の防止**

中圧側または高圧側と低圧側を結合する変圧器は、中圧又は高圧側の電圧の侵入による低圧側の電気設備の損傷、感電又は火災の恐れがないよう当該変圧器における適切な箇所に接地を施さなければならない。

**第 14 条： 過電流に対する保護対策**

電路の必要な箇所には、過電流による過熱焼損から電線及び電気機械器具を保護し、かつ火災の発生を防止できるよう過電流遮断器、その他の適切な機器を施設しなければならない。

**第 15 条： 地絡に対する保護対策**

電路には、地絡が生じた場合に、電線若しくは電気機械器具の損傷、感電又は火災のおそれがないよう、地絡遮断器の施設その他の適切な措置を講じなければならない。

～ 電氣的、磁氣的障害の防止 ～

**第 16 条： 電気設備の電氣的、磁氣的障害の防止**

電気設備は、他の電気設備その他の物件の機能に電氣的又は磁氣的な障害を与えないように施設しなければならない。したがって、電氣的又は磁氣的な障害のレベルは、SNI に規定されている値としなくてはならない。

～ 供給支障の防止 ～

**第 17 条： 電気設備による供給支障の防止**

中圧、高圧又は特別高圧の電気設備（供給・利用）は、その損壊により、電気事業者の電力供給に著しい支障を及ぼさないようにしなければならない。

～ 公害等の防止 ～

**第 18 条： 公害等の防止**

環境公害を防止するために、電力設備は、インドネシアの環境関係法令を遵守しなければならない。

## パート II 電力設備の施設

### 第 1 章 電力流通設備

#### 1-1 電気の供給のための電気設備

##### ～ 感電、火災等の防止 ～

#### 第 19 条： 電線路の感電又は火災の防止

電線路は、感電、火災のおそれ、又は人身の健康、通信線路に影響を及ぼさないように施設しなければならない。

#### 第 20 条： 架空電線及び地中電線の感電の防止

1. 低圧、中圧、高圧又は特別高圧の架空電線には、感電のおそれがないよう、使用電圧に応じた絶縁性能を有する絶縁電線、又はケーブルを使用しなければならない。
2. 地中電線（地中電線路の電線をいう。以下同じ。）には、感電のおそれがないよう、使用電圧に応じた絶縁性能を有するケーブルを使用しなければならない。

#### 第 21 条： 変電所等への取扱者以外の者の立入の防止

中圧、高圧又は特別高圧の電気機械器具、母線等を施設する変電所、開閉所若しくはこれらに準ずる場所には、取扱者以外の者に電気機械器具、母線等が危険である旨を表示するとともに、当該者が容易に構内に立ち入るおそれがないように適切な措置を講じなければならない。

#### 第 22 条： 架空電線路の支持物の昇塔防止

架空電線路の支持物には、感電のおそれがないよう、取扱者以外の者が容易に昇塔できないように適切な措置を講じなければならない。

#### 第 23 条： 架空電線等の高さ

1. 架空電線は、接触又は誘導作用による感電のおそれがなく、かつ、交通に支障を及ぼすおそれがない高さに施設しなければならない。
2. 支線は、交通に支障を及ぼすおそれがない高さに施設しなければならない。

#### 第 24 条： 架空電線による他人の電線等の作業者への感電の防止

1. 架空電線路の支持物は、他人の設置した架空電線路又は架空弱電流電線路若しくは架空光ファイバーケーブル線路の電線又は弱電流電線若しくは光ファイバーケーブルの間を貫通して施設してはならない。
2. 架空電線は、他人の設置した架空電線路又は架空弱電流電線路若しくは架空光ファイバーケーブル線路の支持物を挟んで施設してはならない。

#### 第 25 条： 架空電線路からの静電誘導又は電磁誘導による感電の防止

1. 中圧、高圧又は特別高圧の架空電線路は、常時静電誘導作用により人による感知のおそれがないよう、地表上 1 メートルにおける電界強度が 5 キロボルト毎メートル以下になるように施設しなければならない。ただし、田畑、山林その他の人の往来が少ない場所において、人体に危害を及ぼすおそれがないように施設する場合は、この限りでない。
2. 中圧、高圧、特別高圧の架空電線路は、電磁誘導作用により弱電流電線路（電力保安通信設備を除く。）を通じて人体に危害を及ぼすおそれがないように施設しなければならない。

#### ～ 他の電線、他の工作物等への危険の防止 ～

##### 第 26 条： 電線の混触の防止

電線路の電線は、他の電線又は弱電流電線等と接近し、若しくは交さする場合又は同一支持物に施設する場合には、他の電線又は弱電流電線等を損傷するおそれがなく、かつ、接触、断線等によって生じる混触による感電又は火災のおそれがないように施設しなければならない。

##### 第 27 条： 電線による他の工作物等への危険の防止

電線路の電線は、他の工作物又は植物と接近し、又は交さる場合には、他の工作物又は植物を損傷するおそれがなく、かつ、接触、断線等によって生じる感電又は火災のおそれがないように施設しなければならない。

##### 第 28 条： 地中電線等による他の電線及び工作物への危険の防止

地中電線、屋側電線及びトンネル内電線その他の工作物に固定して施設する電線は、他の電線、弱電流電線等又は管（他の電線等という。以下この条において同じ。）と接近し、又は交さる場合には、故障時のアーク放電により他の電線等を損傷するおそれがないように施設しなければならない。

## 第 29 条： 異常電圧による架空電線等への障害の防止

1. 中圧、高圧又は特別高圧の架空電線と低圧又は異なる電圧階級の架空電線を同一支持物に施設する場合は、異常時の高電圧の侵入により低圧側又は異なる電圧階級の電気設備に障害を与えないよう、接地その他の適切な措置を講じなければならない。
2. 中圧、高圧、特別高圧架空電線路の電線の上方において、その支持物に低圧の電気機械器具を施設する場合は、異常時の高電圧の侵入により低圧側の電気設備へ障害を与えないよう、接地その他の適切な措置を講じなければならない。

## ～ 支持物の倒壊による危険の防止 ～

### 第 30 条： 支持物の倒壊の防止

1. 架空電線路又は架空電車線路の支持物の材料及び構造（支線を施設する場合は、当該支線に係るものを含む。）は、その支持物が支持する電線等による引張荷重、風圧荷重及び当該設置場所において通常想定される気象の変化、振動、衝撃その他の外部環境の影響を考慮し、倒壊のおそれがないよう、安全なものでなければならない。
2. 中圧、高圧又は特別高圧架空電線路の支持物は、構造上安全なものとする等により連鎖的に倒壊のおそれがないように施設しなければならない。

## ～ 高圧ガス等による危険の防止 ～

### 第 31 条： ガス絶縁機器等の危険の防止

変電所、開閉所若しくはこれらに準ずる場所に施設するガス絶縁機器及び開閉器又は遮断器に使用する圧縮空気装置は、次の各号により施設しなければならない。

- 1) 圧力を受ける部分の材料及び構造は、最高使用圧力に対して十分に耐え、かつ安全なものであること。
- 2) 圧縮空気装置の空気タンクは、耐食性を有すること。
- 3) 圧力が上昇する場合において、当該圧力が最高使用圧力に到達する以前に当該圧力を低下させる機能を有すること。
- 4) 圧縮空気装置は、主空気タンクの圧力が低下した場合に圧力を自動的に回復させる機能を有すること。
- 5) 異常な圧力を早期に検知できる機能を有すること。
- 6) ガス絶縁機器に使用する絶縁ガスは、可燃性、腐食性及び有毒性のないものであること。

～ 危険な施設の防止 ～

**第 32 条： 油入開閉器等の施設制限**

絶縁油を使用する開閉器、断路器及び遮断器は、架空電線路の支持物に施設してはならない。

**第 33 条： 電線路のがけへの施設の禁止**

電線路は、がけに施設してはならない。

～ 電氣的、磁氣的障害の防止 ～

**第 34 条： 通信障害の防止**

1. 電線路は、無線設備の機能に継続的かつ重大な障害を及ぼす電波を発生するおそれがないように施設しなければならない。
2. 電線路は、弱電流電線路に対し、誘導作用により通信上の障害を及ぼさないように施設しなければならない。

～ 供給支障の防止 ～

**第 35 条： 変電設備等の損傷による供給支障の防止**

1. 燃料電池又は常用電源として用いる蓄電池には、当該電気機械器具を著しく損壊するおそれがあり、又は一般電気事業に係る電気の供給に著しい支障を及ぼすおそれがある異常が当該電気機械器具に生じた場合に自動的にこれを電路から遮断する装置を施設しなければならない。
2. 中圧、高圧又は特別高圧の変圧器又は調相設備には、当該電気機械器具を著しく損壊するおそれがあり、又は一般電気事業に係る電気の供給に著しい支障を及ぼすおそれがある異常が当該電気機械器具に生じた場合に自動的にこれを電路から遮断する装置の施設その他の適切な措置を講じなければならない。

**第 36 条： 変圧器等の機械的強度**

変圧器、調相設備並びに母線及びこれを支持するがいしは、短絡電流により生ずる機械的衝撃に耐えるものでなければならない。

**第 37 条： 常時監視をしない変電所等の施設**

変電所であって、変電所の運転に必要な知識及び技能を有する者が当該変電所において常時監視をしない変電所は、非常用予備電源を除き、異常が生じた場合に安全かつ確実に停止することができるような措置を講じなければならない。

### 第 38 条： 地中電線路の保護

1. 地中電線路は、車両その他の重量物による圧力に耐え、かつ、当該地中電線路を埋設している旨の表示等により掘削工事からの影響を受けないように施設しなければならない。
2. 地中電線路のうちその内部で作業が可能なものには、防火措置を講じなければならない。

### 第 39 条： 特別高圧架空電線路の供給支障の防止

1. 特別高圧架空電線路は、市街地その他人家の密集する地域に施設してはならない。ただし、当該地域からの火災による当該電線路の損壊によって一般電気事業に係る電気の供給に著しい支障を及ぼすおそれがないように施設する場合は、この限りでない。
2. 特別高圧架空電線と建造物との水平距離は、当該建造物からの火災による当該電線の損壊等によって一般電気事業に係る電気の供給に著しい支障を及ぼすおそれがないよう、4メートル以上としなければならない。
3. 特別高圧架空電線が、建造物、道路、歩道橋その他の工作物の下方に施設されるときの相互の水平離隔距離は、当該工作物の倒壊等による当該電線の損壊によって一般電気事業に係る電気の供給に著しい支障を及ぼすおそれがないよう、4メートル以上としなければならない。

### 第 40 条： 中圧、高圧及び特別高圧の電路の避雷器等の施設

雷電圧による電路に施設する電気設備の損壊を防止できるよう、当該電路中次の各号に掲げる箇所又はこれに近接する箇所には、避雷器の施設その他の適切な措置を講じなければならない。

- 1) 変電所若しくはこれに準ずる場所の架空電線引込口及び引出口。
- 2) 架空電線路に接続する配電用変圧器であって、過電流遮断器の設置等の保安上の保護対策が施されているものの中圧、高圧側及び特別高圧側。
- 3) 中圧、高圧又は特別高圧の架空電線路から供給を受ける需要場所の引込口。

### 第 41 条： 電力保安通信設備の施設

1. 変電所、開閉所、給電所（電力系統の運用に関する指令を行う所をいう。）、技術員駐在所その他の箇所であって、一般電気事業に係る電気の供給に対する著しい支障を防ぎ、かつ、保安を確保するために必要なものの相互間には、電力保安通信用電話設備を施設しなければならない。
2. 電力保安通信線は、機械的衝撃、火災等により通信の機能を損なうおそれがないように施設しなければならない。

## 第 42 条： 災害時における通信の確保

電力保安通信設備に使用する無線通信用アンテナ又は反射板（以下この条において「無線用アンテナ等」という。）を施設する支持物の材料及び構造は、風圧荷重を考慮し、倒壊により通信の機能を損なうおそれがないように施設しなければならない。ただし、電線路の周囲の状態を監視する目的で施設する無線用アンテナ等を架空電線路の支持物に施設するときは、この限りでない。

### 1-2 電力利用場所における施設

#### ～ 感電、火災等の防止 ～

##### 第 43 条： 電力利用場所における配線の感電又は火災の防止

1. 電力利用場所における配線は、施設場所の状況及び電圧に応じ、感電又は火災の恐れがないように施設しなければならない。
2. 移動電線を電気機械器具と接続する場合は、接続不良による感電又は火災の恐れがないように施設しなければならない。
3. 高圧又は特別高圧の場合は、第 1 項、2 項にかかわらず、移動電線を施設してはならない。

##### 第 44 条： 電力利用場所における配線の使用電線

1. 裸電線を除き、配線に使用する電線には、感電または火災の恐れがないよう、施設場所の状況及び電圧に応じ、使用上十分な機械的強度及び絶縁性能を有するものでなければならない。
2. 配線に裸電線を使用してはならない。

##### 第 45 条： 電力利用場所に施設する電気機械器具の感電、火災の防止

電力利用場所に施設する電気機械器具は、充電部の露出がなく、かつ人体 に危害を及ぼし、又は火災が発生するおそれがある発熱がないように施設しなければならない。

ただし、電気機械器具を使用するために充電部の露出又は発熱体の施設が不可欠である場合であって、感電その他人体に危害を及ぼし、又は火災が発生する恐れがないように施設する場合は、この限りではない。

#### ～ 他の配線、他の工作物等への危険の防止 ～

##### 第 46 条： 配線による他の配線又は工作物への危険の防止

1. 配線は、他の配線または通信線と接近し、又は交さる場合は、混触による感電または火災の恐れがないように施設しなければならない。



2. 配線は、水道管、ガス管またはこれらに類するものと接近し、又は交さる場合は、放電によりこれらの工作物を損傷する恐れがなく、かつ漏電又は放電によりこれらの工作物を介して感電又は火災の恐れがないように施設しなければならない。

～ 異常時の保護対策 ～

**第 47 条： 過電流からの配線の保護**

過熱による電気機械器具の火災を防止するために、過電流保護装置を適切な場所に施設しなければならない。なお、複数の電流保護装置を設置する場合は、主・後備の保護強調を考慮し、設置しなくてはならない。

**第 48 条： 電力利用箇所における地絡に対する保護対策**

地絡が生じた場合、感電又は火災の恐れがないよう地絡保護装置その他適切な措置を講じなければならない。

## 第2章 発電設備（一般条項）

### 第49条： 発電所等への取扱者以外の者の立入の防止

中圧、高圧又は特別高圧の電気機械器具、母線等を施設する発電所若しくはこれらに準ずる場所には、取扱者以外の者に電気機械器具、母線等が危険である旨を表示するとともに、当該者が容易に構内に立ち入るおそれがないように適切な措置を講じなければならない。

### 第50条： 水素冷却式発電機等の施設

水素冷却式の発電機、又はこれに附属する水素冷却装置は、次の各号により施設しなければならない。

- 1) 構造は、水素の漏洩又は空気の混入のおそれがないものであること。
- 2) 発電機、水素を通ずる管、弁等は、水素が大気圧で爆発する場合に生じる圧力に耐える強度を有するものであること。
- 3) 発電機の軸封部から水素が漏洩したときに、漏洩を停止させ、又は漏洩した水素を安全に外部に放出できるものであること。
- 4) 発電機内への水素の導入及び発電機内からの水素の外部への放出が安全にできるものであること。
- 5) 異常を早期に検知し、警報する機能を有すること。

### 第51条： 発電設備等の損傷による供給支障の防止

発電機には、当該電気機械器具を著しく損壊するおそれがあり、電気の供給に著しい支障を及ぼすおそれがある異常が当該電気機械器具に生じた場合に自動的にこれを電路から遮断する装置を施設しなければならない。

### 第52条： 発電機等の機械的強度

1. 発電機、母線及びこれを支持するがいしは、短絡電流により生ずる機械的衝撃に耐えるものでなければならない。
2. 水車に接続する発電機の回転する部分は、負荷を遮断した場合に起こる速度に対し、蒸気タービン、ガスタービン又は内燃機関に接続する発電機の回転する部分は、非常調速装置及びその他の非常停止装置が動作して達する速度に対し、耐えるものでなければならない。
3. 発電機は、主要な軸受又は軸に発生しうる最大の振動に対して構造上十分な機械的強度を有するものでなければならない。

### 第 53 条： 常時監視をしない発電所等の施設

1. 以下の発電所で、発電所の運転に必要な知識及び技能を有する者が当該発電所又はこれと同一の構内にいない発電所や常時監視をしない発電所は施設してはならない。
  - 1) 異常が生じた場合に人体や物件に損傷を与えるおそれがあり、異常の状態に応じた制御が必要となる発電所
  - 2) 異常が生じた場合に一般電気事業に係る電気の供給に著しい支障を及ぼすおそれがある発電所
  - 3) 異常を早期に発見する必要のある発電所
2. 前項に掲げる発電所以外の発電所又は変電所であって、発電所又は変電所の運転に必要な知識及び技能を有する者が当該発電所若しくはこれと同一の構内又は変電所において常時監視をしない発電所又は変電所は、非常用予備電源を除き、異常が生じた場合に安全かつ確実に停止することができるような措置を講じなければならない。

### 第 54 条： 電力保安通信設備の施設

1. 発電所、変電所、開閉所、給電所（電力系統の運用に関する指令を行う所をいう。）、技術員駐在所その他の箇所であって、一般電気事業に係る電気の供給に対する著しい支障を防ぎ、かつ、保安を確保するために必要なものの相互間には、電力保安通信用電話設備を施設しなければならない。
2. 電力保安通信線は、機械的衝撃、火災等により通信の機能を損なうおそれがないように施設しなければならない。

### 第 55 条： 災害時における通信の確保

電力保安通信設備に使用する無線通信用アンテナ又は反射板（以下この条において「無線用アンテナ等」という。）を施設する支持物の材料及び構造は、風圧荷重を考慮し、倒壊により通信の機能を損なうおそれがないように施設しなければならない。ただし、電線路の周囲の状態を監視する目的で施設する無線用アンテナ等を架空電線路の支持物に施設するときを除く。

### 第 56 条： 電動機の過負荷保護

屋内に施設する電動機（出力が 0.2 キロワット以下のものを除く。）には、過電流による当該電動機の焼損により火災が発生するおそれがないよう、過電流遮断器の施設その他の適切な措置を講じなければならない。ただし、電動機の構造上又は負荷の性質上電動機を焼損するおそれがある過電流が生じるおそれがない場合は、この限りでない。

## 第3章 水力発電設備

### 3-1 総則

#### 第57条： 適用範囲

1. この章は、水力を原動力として電気を発生するために施設する設備について適用する。
2. この章は、以下の基準を満たしたダムには適用しない。
  - 1) ダムの基礎から測定して高さ 15m 以上、且つ許容量 10 万立方メートル以上、  
或いは
  - 2) ダムの基礎から測定して高さ 15m 未満、且つ許容量 50 万立方メートル以上、  
或いは
  - 3) ダム安全委員会（KKB）が定めた 1) と 2) 以外のダム

#### 第58条： 定義

この省令において、次の各号に掲げる用語の意義は、以下のように定める。

- 1) 「水路」とは、取水設備、沈砂池、導水路、ヘッドタンク、サージタンク、水圧管路（ヘッドタンク又はサージタンク（ヘッドタンク及びサージタンクがない場合は、取水設備）から水車に直接導水するための施設をいう。以下同じ。）及び放水路をいう。
- 2) 「設計洪水位」とはダムの直上流の地点において、200年につき1回の割合で発生するものと予想される洪水の流量の流水がダムの洪水吐きを流下する場合におけるダムの非越流部の直上流における最高の水位をいう。ただし、高さ15メートル未満の流量調節を目的としないダムにあっては、当該ダムに係る流域の水象又は気象の観測の結果により求めた当該ダムの直上流の地点における洪水の流量の流水がダムを流下する場合におけるダムの直上流における最高の水位をいう。

#### 第59条： 防護施設等

ダム、水路等の人転落のおそれがある箇所には、さく、塀等の防護施設を設けるか、又は危険である旨を表示しなければならない。ただし、土地の状況等により公衆が容易に立ち入るおそれがない箇所については除く。

## 3-2 ダム

### 3-2-1 通則

#### 第 60 条： ダム

ダムは、次の各号により施設しなければならない。

- 1) コンクリート重力ダム及びコンクリート中空重力ダムは、水位、流量その他の河川の状況並びに自重、静水圧、動水圧、泥圧、地震力及び揚圧力を考慮した安全な構造のものであること。
- 2) フィルダムは、水位、流量その他の河川の状況並びに自重、静水圧、地震力及び間げき圧を考慮した安全な構造のものであること。
- 3) 前各号に掲げるダム以外のダムは、水位、流量その他の河川の状況及び自重、水圧その他の予想される荷重を考慮した安全な構造のものであること。

#### 第 61 条： 非越流部頂の位置

ダムの堤体の非越流部頂の高さは、設計洪水水位に余裕高（ダムの種類及び洪水吐きゲートの有無に応じた値）を加えた値でなければならない。

設計洪水水位に対する余裕高（最低余裕高）

$hw + ha + hi$  かつ 1m 以上

ここで、

$hw$ ：風による波浪高

$ha$ ：洪水吐ゲートを有する場合は 0.5m、洪水吐ゲートを有しない場合は 0m

$hi$ ：フィルダムの場合は 1m、コンクリートダムの場合は 0m

#### 第 62 条： 基礎地盤

ダムの基礎地盤は、ダムの安定に必要な強度及び水密性を有するものでなければならない。

#### 第 63 条： ダムのコンクリートの材料

ダムに使用するコンクリートの材料は、次の各号によらなければならない。

- 1) セメントは、その品質に応じて、適切に凝結し、固化するものであること。
- 2) 骨材は、強硬で耐久性のあるものであること。
- 3) 骨材、水又は混和材料は、コンクリートの凝結を妨げ、鉄筋を著しくさびさせ、又はコンクリートと鉄筋との付着を妨げる酸、塩、有機物又は泥土を含まないこと。

## 第 64 条： 漏水の防止

堤体及び堤体とその基礎地盤との接触部は、危険な漏水が生じないものでなければならない。

## 第 65 条： ダムの洪水吐き

1. 堤体又はその付近には、洪水に適切に対処するために、次の各号により洪水吐きを施設しなければならない。
  - 1) 洪水吐きは、フィルダムの場合は堤体の付近、その他のダムの場合は堤体又はその付近に設けること。
  - 2) 洪水吐き（ゲートを除く。）は、自重、静水圧、動水圧、泥圧、地震力、揚圧力及び温度荷重並びに設計洪水位において当該洪水吐きからの総放水量が流下する場合の荷重に対し安定であること。
  - 3) 洪水吐き（ゲートを除く。）のコンクリート構造物に作用する自重、静水圧、動水圧、泥圧、地震力、揚圧力及び温度荷重並びに設計洪水位において当該洪水吐きからの総放水量が流下する場合の荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
  - 4) 洪水吐きは、設計洪水位において洪水吐きからの総放水量が流下する場合に安全を保ち、ダム及びその付近に悪影響を及ぼすおそれがないようにすること。
  - 5) 洪水吐きの機能に支障を及ぼすような流下物が流入するおそれがないようにすること。
2. 前項の洪水吐きのゲートは、次の各号により施設しなければならない。
  - 1) 水密性を有すること。
  - 2) 扉体の開閉が容易かつ確実であること。
  - 3) 扉体を使用する材料は、扉体に必要な化学的成分及び機械的性能を有するものであること。
  - 4) 扉体に作用する自重、静水圧、動水圧、泥圧、地震力、浮力及び開閉力による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
  - 5) 扉体の開閉の際に、危険な振動がないこと。
  - 6) 扉体は、座屈しない構造であること。
  - 7) 扉体に加わる荷重を堤体等に安全に伝える構造であること。
  - 8) 扉体の開閉に異常が発生した場合に当該扉体を確実に停止できること。
  - 9) 扉体の作動状況を操作員に対して知らせるための装置を設けること。

## 第 66 条： 洪水吐き以外の放流設備

洪水吐き以外の放流設備は、ダム及びその付近に悪影響を及ぼすおそれがないように施設しなければならない。

### 3-2-2 コンクリート重力ダム

#### 第 67 条： 堤体の強度

1. コンクリート重力ダムの堤体に作用する自重、静水圧、動水圧、泥圧、地震力及び揚圧力による圧縮応力は、使用するコンクリートごとにそれぞれの許容圧縮応力を超えてはならない。
2. コンクリート重力ダムの堤体（引張応力に対し鉄筋で補強されている越流部付近の部分を除く。次項において同じ。）に作用する自重、静水圧、動水圧、泥圧、地震力及び揚圧力による引張応力は、次項に規定する場合は除き、使用するコンクリートごとにそれぞれの許容引張応力を超えてはならない。
3. コンクリート重力ダムの堤体に作用する自重、静水圧、動水圧、泥圧、地震力及び揚圧力による引張応力は、当該堤体の上流端において鉛直方向に生ずるものであってはならない。

#### 第 68 条： 堤体の安定

コンクリート重力ダムは、堤体及び堤体と基礎地盤との接触部における滑りに対して安定であること。

#### 第 69 条： 堤体の施設

コンクリート重力ダムの堤体は、次の各号により施設しなければならない。

- 1) コンクリートに有害なひび割れを生じないようにすること。
- 2) 堤体の内部に設ける通廊、放流設備、水圧管路等の開孔の周辺部分は、応力集中及び温度変化による応力に対し構造上安全であること。
- 3) コンクリート中空重力ダムのヘッド又はフーチングとウェブとの接合部は、応力集中による応力に対し構造上安全であること。

### 3-2-3 フィルダム

#### 第 70 条： 堤体の材料

1. フィルダムの堤体に使用する土質材料は、次の各号に適合するものでなければならない。
  - 1) ダムの安定に必要な強度及び水密性を有するものであること。
  - 2) ダムの安定に支障を及ぼすような膨張性又は収縮性がないものであること。

- 3) 軟泥化しないものであること。
  - 4) 有機物を含まず、かつ、水溶性のものでないこと。
2. フィルダムの遮水壁に使用する土質材料以外の材料は、ダムの安定に必要な水密性、強度及び耐久性を有するものであること。
  3. フィルダムの遮水壁以外の堤体の部分に使用する土質材料以外の材料は、ダムの安定に必要な強度、耐久性及び透水性を有するものであること。

#### **第 71 条： 堤体の安定**

フィルダムは、堤体における滑りに対して安定であること。

#### **第 72 条： 堤体の施設**

フィルダムの堤体は、次の各号により施設しなければならない。

1. フィルダムの遮水壁は、次によること。
  - 1) 遮水壁の頂部の高さは、設計洪水位に洪水吐きゲートの有無に応じた余裕高を加えた値以上であること。
  - 2) 変形又はひび割れにより遮水機能を失わないものであること。
  - 3) 遮水壁及び遮水壁と基礎地盤との接触部に貫孔作用を生じないものであること。
  - 4) 遮水壁の材料が土質材料の場合は、遮水壁の上流面及び下流面は、その材料が流出しないようにすること。
2. 堤体におおむね均一の材料を使用しているフィルダムにあつては、浸潤線が堤体の下流のり面と交わらないようにすること。
3. フィルダムの堤体ののり面は、波浪又は雨水等により浸食されないこと。

#### **第 73 条： 放流設備等の施設制限**

フィルダムの堤体には、放流設備又は水路を施設してはならない。

### **3-3 水路**

#### **第 74 条： 一般事項**

1. 水路は、次の各号により施設しなければならない。
  - 1) 洪水、山崩れ等により損傷を受けるおそれがないこと。
  - 2) 設計水量以上の水量が流入するおそれがある場合には、その水量を安全に排除できること。



- 3) 流木、ごみ、土砂等の流入により著しく損傷を受けるおそれがないこと。
  - 4) 水路に使用するコンクリートの材料は、第 63 条各号によること。
  - 5) 水路に使用するコンクリート以外の材料は、水路に必要な化学的成分及び機械的性能を有するものであること。
  - 6) 制水門又は制水弁を設ける場合にあつては、次によること。
    - a) 制水門又は制水弁は、第 65 条第 2 項各号（ただし、3）及び 4）を除く。）によること。
    - b) 制水門、又は制水弁の扉体に作用する自重、静水圧、動水圧、地震力及び浮力による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
2. 発電水力設備が一般用電気工作物である場合には、水路は全負荷を遮断した場合に、人家、田畑又は道路その他財産を侵害せず安全に余水を処理できるよう施設しなければならない。ただし、当該設備周辺の地形その他状況からみて人家、田畑、又は道路、その他財産を侵害するおそれがない場所にあるものについては除く。

#### 第 75 条： 取水設備

取水設備は、次の各号により施設しなければならない。

- 1) 取水設備は、自重、静水圧、動水圧、泥圧、地震力、揚圧力及び土圧に対し安定であり、かつ、これらの荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
- 2) 取水設備が圧力導水路又は水圧管路の管胴本体に直接接続している場合は、取水設備は、良好な流入状況を保持することができ、かつ、水路及び水車に悪影響を及ぼすおそれのない構造であること。
- 3) 取水設備は、水路への流入量が構造物の設計水量以上となるおそれがない場合又は溪流取水設備である場合を除き、制水門又は制水弁を設けること。

#### 第 76 条： 沈砂池

沈砂池は、次の各号により施設しなければならない。

- 1) 沈砂池は、自重、水圧、地震力及び土圧に対し安定であり、かつ、これらの荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
- 2) 下流の水路及び水車に著しく損傷を与えるおそれがある土砂を沈殿させる能力を有すること。

#### 第 77 条： 導水路

導水路は、次の各号により施設しなければならない。

- 1) 導水路は、自重、水の重量、水圧、地震力、土圧、載荷重、風荷重、温度荷重及び外圧に対し安定であり、かつ、これらの荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
- 2) 漏水により人家、田畑、道路等に悪影響を及ぼすおそれがないこと。
- 3) トンネル又は開きよを巻き立てない場合は、はだ落ち等により水路及び水車に著しい損傷を与えるおそれがないこと。
- 4) 圧力導水路にあつては、次によること。
  - a) 取水設備及びサージタンクにおける水位が最低の場合の動水こう配線以下に位置すること。
  - b) 圧力導水路に溪流取水等を合流させる場合は、空気の連行により水路及び水車に著しい損傷を与えるおそれがないこと。
  - c) 充水する場合における空気の流出及び排水する場合における空気の流入が容易かつ確実な構造であること。

#### 第78条： ヘッドタンク

ヘッドタンクは、次の各号により施設しなければならない。

- 1) ヘッドタンクは、自重、水圧、地震力及び土圧に対し安定であり、かつ、これらの荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
- 2) 水圧管路の管胴本体の入口は、良好な流入状況を保持することができ、かつ、水圧管路及び水車に悪影響を及ぼすおそれのない構造であること。
- 3) ヘッドタンクは、全負荷を遮断した場合に余水を安全に処理する機能を有すること。ただし、ヘッドタンク以外の施設が余水を安全に処理できる場合又は当該設備周辺の地形その他状況からみて人家、田畑又は道路その他財産を侵害するおそれがない場所にあるものについては、除く。
- 4) 前号の場合において、ヘッドタンクに余水吐き及び余水路を設ける場合は、次によること。
  - a) 路式の余水路において、過大な負圧が生じないようにすること。
  - b) 余水の放流により、余水吐き、余水路又は人家、田畑、道路等に悪影響を及ぼすおそれがないこと。
  - c) 余水が越流する場合の水位上昇が導水路に悪影響を及ぼすおそれがないようにすること。

#### 第79条： サージタンク

サージタンクは、次の各号により施設しなければならない。

- 1) サージタンクは、自重、水の重量、水圧、地震力、土圧、風荷重及び温度荷重に対し安定であり、かつ、これらの荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
- 2) 水位の変動が加速されず、短時間で平衡状態に回復すること。
- 3) 次に掲げる場合について、水位の変動により溢水するおそれはなく、かつ、水路又は水車に悪影響を及ぼすおそれがないこと。ただし、溢水するおそれについては、余水を安全に放流するための余水吐き及び余水路を第 78 条の 4) の a) 及び b) により施設する場合は、この限りでない。
  - a) 全負荷遮断した場合。
  - b) 半負荷から全負荷に急増した場合。
  - c) 揚水式水力発電所にあつては、入力遮断した場合。
- 4) 周波数調整用の水力発電所のサージタンクは、当該発電所の属する電力系統の周波数の変動による水位の変動により他の物件に損傷を与えるおそれがないこと。

#### 第 80 条： 水圧管路

水圧管路は、次の各号により施設しなければならない。

- 1) 次の表の上欄に掲げる形式の水圧管路にあつては、それぞれ同表の下欄に掲げる荷重による応力は、使用する材料ごとに、それぞれの許容応力を超えないこと。

水圧管路の種類	露出形式	岩盤埋設形式	土中埋設形式
荷重	静水圧、水撃圧及びサージングによる上昇水圧の合成最大水圧、管の自重、温度荷重、外圧、管内水の重量、地震力、風荷重並びに管内の流水による力	静水圧、水撃圧及びサージングによる上昇水圧の合成最大水圧、温度荷重並びに外圧	静水圧、水撃圧及びサージングによる上昇水圧の合成最大水圧、土圧、載荷重、温度荷重、外圧並びに管内水の重量

- 2) 管胴本体は、振動、座屈及び腐食に対し安全であること。
- 3) ヘッドタンク又はサージタンク（これらが無い場合は、取水設備）の水位が最低の場合における最低動水こう配線以下に位置すること。
- 4) 危険な漏水がないこと。
- 5) アンカーブロックは、次によること。
  - a) 管胴本体を確実に固定するものであること。

- b) アンカーブロックは、自重、管胴本体及びその附属設備並びに管内の水の重量、管内の流水による力、漸縮管に作用する水圧による力、地震力、載荷重、風荷重並びに温度荷重に対し安定であり、かつ、これらの荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
- 6) 支台は、次によること。
- a) 支台は、自重、管胴本体及びその附属設備並びに管内の水の重量、地震力、載荷重並びに風荷重に対し安定であり、かつ、これらの荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
  - b) 支台の支承部は、管胴本体の伸縮の際に管胴本体が安全かつ円滑に移動できる構造であること。

### 第 81 条： 放水路

1. 第 77 条(ただし、4)の a)及び b)を除く。)の規定は、放水路について準用する。この場合において、同条中「導水路」とあるのは「放水路」、「圧力導水路」とあるのは「圧力放水路」と読み替えるものとする。
2. 放水口は、自重、静水圧、動水圧、地震力、揚圧力及び土圧に対し安定であり、かつ、これらの荷重による応力は、使用する材料ごとにそれぞれの許容応力を超えてはならない。
3. 圧力放水路に調圧水室を設ける場合には、第 79 条の規定に準じて施設しなければならない。

## 3-4 水車及び地下発電所

### 第 82 条： 水車及び揚水用のポンプ

1. 水車又は揚水式水力発電所における揚水用のポンプは、次の各号により施設しなければならない。
  - 1) 流木、ごみ、土砂等の流入により著しく損傷を受けるおそれがないこと。
  - 2) 水圧を受ける部分にあつては負荷又は入力を遮断したときの最大水圧に対し、耐えるものであること。
  - 3) 回転部にあつては負荷又は入力を遮断したときの最大速度に対して、耐えるものであること。
  - 4) 運転中に水車又は揚水用のポンプに損傷を与えるような振動がないこと。
  - 5) 水の流入又は流出を迅速に遮断する施設を水車又は揚水用のポンプに設けること。ただし、当該施設を水路に設ける場合、又は水車の無拘束回転を停止できるまでの間、回転部が構造上安全であり、かつ、この間の下流への放流により人体に危害を及ぼし、若しくは物件に損傷を与えるおそれのない場合は除く。

- 6) 水車の入口弁又は揚水用のポンプの吐出弁を設ける場合にあっては、次によること。
  - a) 水車の入口弁又は揚水用のポンプの吐出弁は、第 65 条第 2 項各号（ただし、4）を除く。）によること。
  - b) 水車の入口弁又は揚水用のポンプの吐出弁の扉体に作用する自重、水圧及び地震力による応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。
2. 発電用水力設備として使用する圧油装置及び圧縮空気装置は、耐食性を有し、圧力上昇による破損がないように施設しなければならない。
3. 発電用水力設備が一般用電気工作物である場合には、運転中に水車で生じた過回転その他の異常による危害等の発生を防止するため、その異常が発生した場合に水車を自動的かつ確実に停止する装置を施設しなければならない。ただし、発電機の容量が五百キロボルトアンペア未満の当該設備において、その異常が発生した場合に発電機を電路から遮断する装置を施設し、無拘束回転を停止できるまでの間、回転部が構造上安全な状態を確保でき、かつ、この間の下流への放流により人体に危害を及ぼし、又は財産を侵害するおそれのないときは除く。

### 第 83 条： 地下発電所等の施設

水車及び発電機を収容する施設であって、地下に施設するものは、次の各号によらなければならない。

- 1) 地下発電所等に使用するコンクリートの材料は、第 63 条各号によること。
- 2) 地下発電所等は、自重、水圧、地震力及び土圧若しくは地圧に対し安定であり、かつ、これらの荷重によりコンクリート構造物の部分に生じる応力は、使用する材料ごとにそれぞれの許容応力を超えないこと。

## 3-5 貯水池及び調整池

### 第 84 条： 貯水池及び調整池

貯水池及び調整池は、次の各号により施設しなければならない。

- 1) ダムの設置による貯水に起因する漏水又は地滑りにより人家、田畑、道路等に悪影響を及ぼすおそれがないこと。
- 2) 土砂の堆積により、ダムに危険を及ぼし、又は付近に悪影響を及ぼすような水位の上昇がないこと。

## 第4章 火力発電設備

### 4-1 総則

#### 第85条： 適用範囲

この基準は、火力（地熱を含む。以下同じ。）を原動力として電気を発生するために施設する設備について適用する。

### 4-2 ボイラー等及びその附属設備

#### 第86条： ボイラー等の材料

ボイラー、独立過熱器又は蒸気貯蔵器（以下「ボイラー等」という。）及びその附属設備に属する容器及び管の耐圧部分に使用する材料は、最高使用温度において材料に及ぼす化学的及び物理的影響に対し、安全な化学的成分及び機械的強度を有するものでなければならない。

#### 第87条： ボイラー等の構造

ボイラー等及びその附属設備の耐圧部分の構造は、最高使用圧力又は最高使用温度において発生する最大の応力に対し安全なものでなければならない。この場合において、耐圧部分に生ずる応力は当該部分に使用する材料の許容応力を超えてはならない。

#### 第88条： 安全弁

ボイラー等及びその附属設備であって過圧が生ずるおそれのあるものにあつては、その圧力を逃がすために適当な安全弁を設けなければならない。この場合において、当該安全弁は、その作動時にボイラー等及びその附属設備に過熱が生じないように施設しなければならない。

#### 第89条： 給水装置

1. ボイラーには、その最大連続蒸発時において、熱的損傷が生ずることのないよう水を供給できる給水装置を設けなければならない。
2. 設備の異常等によりボイラーに損傷が生ずることのないよう、予備の給水装置を設けなければならない。

#### 第90条： 蒸気及び給水の遮断

1. ボイラーの蒸気出口（安全弁からの蒸気出口及び再熱器からの蒸気出口を除く。）は、蒸気の流出を遮断できる構造でなければならない。

2. ボイラーの給水の入口は、給水の流路を速やかに自動で、かつ、確実に遮断できる構造でなければならない。

#### **第 91 条： ボイラーの水抜き装置**

循環ボイラーには、ボイラー水の濃縮を防止し、及び水位を調整するために、ボイラー水を抜くことができる装置を設けなければならない。

#### **第 92 条： 計測装置**

ボイラー等には、設備の損傷を防止するため運転状態を計測する装置を設けなければならない。

### **4-3 蒸気タービン及びその附属設備**

#### **第 93 条： 蒸気タービンの附属設備の材料**

蒸気タービンの附属設備に属する容器及び管の耐圧部分に使用する材料は、最高使用温度において材料に及ぼす化学的及び物理的影響に対し、安全な化学的成分及び機械的強度を有するものでなければならない。

#### **第 94 条： 蒸気タービン等の構造**

1. 蒸気タービンは、非常調速装置が作動したときに達する回転速度に対して構造上十分な機械的強度を有するものでなければならない。
2. 蒸気タービンは、主要な軸受又は軸に発生しうる最大の振動に対して構造上十分な機械的強度を有するものでなければならない。
3. 蒸気タービンの軸受は、運転中の荷重を安定に支持できるものであって、かつ、異常な摩耗、変形及び過熱が生じないものでなければならない。
4. 蒸気タービンの危険速度は、調速装置により調整することができる回転速度のうち最小のものから非常調速装置が作動したときに達する回転速度までの間にあるてはならない。ただし、危険速度における振動が当該蒸気タービンの運転に支障を及ぼすことのないよう十分な対策を講じた場合は、この限りでない。
5. 蒸気タービン及びその附属設備の耐圧部分の構造は、最高使用圧力又は最高使用温度において発生する最大の応力に対し安全なものでなければならない。この場合において、耐圧部分に生ずる応力は当該部分に使用する材料の許容応力を超えてはならない。

#### **第 95 条： 調速装置**

蒸気タービンには、その回転速度及び出力が負荷の変動の際にも持続的に動揺することを防止するため、蒸気タービンに流入する蒸気を自動的に調整する調速装置を設け

なければならない。この場合において、调速装置は、最大負荷を遮断した場合に達する回転速度を非常调速装置が作動する回転速度未満にする能力を有するものでなければならない。

#### **第 96 条： 警報及び非常停止装置**

1. 蒸気タービンには、運転中に支障を及ぼすおそれのある振動を検知し警報する装置を設けなければならない。
2. 蒸気タービンには、運転中に生じた過回転その他の異常による危害の発生を防止するため、その異常が発生した場合に蒸気タービンに流入する蒸気を自動的かつ速やかに遮断する非常调速装置その他の非常停止装置を設けなければならない。

#### **第 97 条： 過圧防止装置**

蒸気タービン及びその附属設備であって過圧が生ずるおそれのあるものにあつては、その圧力を逃がすために適当な過圧防止装置を設けなければならない。

#### **第 98 条： 計測装置**

蒸気タービンには、設備の損傷を防止するため運転状態を計測する装置を設けなければならない。

### **4-4 ガスタービン及びその附属設備**

#### **第 99 条： ガスタービンの附属設備の材料**

ガスタービンの附属設備に属する容器及び管の耐圧部分に使用する材料は、最高使用温度において材料に及ぼす化学的及び物理的影響に対し、安全な化学的成分及び機械的強度を有するものでなければならない。

#### **第 100 条： ガスタービン等の構造**

1. ガスタービンは、非常调速装置が作動したときに達する回転速度及びガスの温度が著しく上昇した場合に燃料の流入を自動的に遮断する装置が作動したときに達するガス温度に対して構造上十分な機械的強度及び熱的強度を有するものでなければならない。
2. ガスタービンの軸受は、運転中の荷重を安定に支持できるものであって、かつ、異常な摩耗、変形及び過熱が生じないものでなければならない。
3. ガスタービンの危険速度は、调速装置により調整することができる回転速度のうち最小のものから非常调速装置が作動したときに達する回転速度までの間にあつてはならない。ただし、危険速度における振動が当該ガスタービンの運転に支障を及ぼすことのないよう十分な対策を講じた場合は、この限りでない。



4. ガスタービン及びその附属設備の耐圧部分の構造は、最高使用圧力又は最高使用温度において発生する最大の応力に対し安全なものでなければならない。この場合において、耐圧部分に生ずる応力は当該部分に使用する材料の許容応力を超えてはならない。

#### **第 101 条： 調速装置**

ガスタービンには、その回転速度及び出力が負荷の変動の際にも持続的に動揺することを防止するため、ガスタービンに流入するエネルギーを自動的に調整する調速装置を設けなければならない。この場合において、調速装置は、定格負荷を遮断した場合に達する回転速度を非常調速装置が作動する回転速度未満にする能力を有するものでなければならない。

#### **第 102 条： 警報及び非常停止装置**

1. ガスタービンには、運転中に支障を及ぼすおそれのある振動を検知し警報する装置を設けなければならない。
2. ガスタービンには、運転中に生じた過回転その他の異常による危害の発生を防止するため、その異常が発生した場合にガスタービンに流入するエネルギーを自動的にかつ速やかに遮断する非常調速装置その他の非常停止装置を設けなければならない。

#### **第 103 条： 過圧防止装置**

ガスタービンの附属設備であって過圧が生ずるおそれのあるものにあつては、その圧力を逃がすために適当な過圧防止装置を設けなければならない。

#### **第 104 条： 計測装置**

ガスタービンには、設備の損傷を防止するため運転状態を計測する装置を設けなければならない。

### **4-5 内燃機関及びその附属設備**

#### **第 105 条： 内燃機関の附属設備の材料**

内燃機関の附属設備に属する容器及び管の耐圧部分に使用する材料は、最高使用温度において材料に及ぼす化学的及び物理的影響に対し、安全な化学的成分及び機械的強度を有するものでなければならない。

#### 第 106 条： 内燃機関等の構造等

1. 内燃機関は、非常調速装置が作動したときに達する回転速度に対して構造上十分な機械的強度を有するものでなければならない。
2. 内燃機関の軸受は、運転中の荷重を安定に支持できるものであって、かつ、異常な摩耗、変形及び過熱が生じないものでなければならない。
3. 内燃機関及びその附属設備の耐圧部分の構造は、最高使用圧力又は最高使用温度において発生する最大の応力に対し安全なものでなければならない。この場合において、耐圧部分に生ずる応力は当該部分に使用する材料の許容応力を超えてはならない。
4. 内燃機関を屋内その他酸素欠乏の発生のおそれのある場所に設置するときは、給排気部を適切に施設しなければならない。

#### 第 107 条： 調速装置

内燃機関には、その回転速度及び出力が負荷の変動の際にも持続的に動揺することを防止するため、内燃機関に流入する燃料を自動的に調整する調速装置を設けなければならない。この場合において、調速装置は、定格負荷を遮断した場合に達する回転速度を非常調速装置が作動する回転速度未満にする能力を有するものでなければならない。

#### 第 108 条： 非常停止装置

内燃機関には、運転中に生じた過回転その他の異常による危害の発生を防止するため、その異常が発生した場合に内燃機関に流入する燃料を自動的にかつ速やかに遮断する非常調速装置その他の非常停止装置を設けなければならない。

#### 第 109 条： 過圧防止装置

内燃機関及びその附属設備であって過圧が生ずるおそれのあるものにあつては、その圧力を逃がすために適当な過圧防止装置を設けなければならない。

#### 第 110 条： 計測装置

内燃機関には、設備の損傷を防止するため運転状態を計測する装置を設けなければならない。

## 4-6 液化ガス設備

### 第 111 条：定義

1. 「液化ガス」とは、通常の使用状態での温度における飽和圧力が 0.2MPa 以上であって、現に液体の状態であるもの又は圧力が 0.2MPa における飽和温度が 35℃以下であって、現に液体の状態であるものをいう。
2. 「導管」とは、燃料若しくはガス又は液化ガスを輸送するための管及びその附属機器であって、構外に施設するものをいう。

### 第 112 条：離隔距離

1. 液化ガス設備は、その外面と発電所の境界線との間に、ガス又は液化ガスの漏洩又は火災等による危害を防止するために、保安上必要な距離を有するものでなければならない。
2. 液化ガス設備のうち、貯槽、気化器、ポンプ、圧縮機、及び、ガスホルダーは、その外面から住居の用に供する建築物、または、学校、病院、市場、駅等、多数の者を収容する施設、もしくは重要な文化財等との間に、ガス又は液化ガスの漏洩又は火災等による危害を防止するために、液化ガス設備の貯蔵能力又は処理能力、及び、ガス又は液化ガスの種類により定められる距離を有するものでなければならない。
3. 液化ガス用貯槽の相互間、ガスホルダーの相互間並びに液化ガス用貯槽及びガスホルダーの相互間は、ガス又は液化ガスの漏洩又は火災等による危害を防止するために、保安上必要な距離を有するものでなければならない。

### 第 113 条：保安区画

液化ガス用気化器を有する発電所における液化ガス設備は、ガス又は液化ガスの漏洩又は火災等による危害を防止するために、設備の種類及び規模に応じ、保安上適切な区画に区分して設置し、かつ、設備相互の間には保安上必要な距離を有するものでなければならない。

### 第 114 条：設備の設置場所

1. 貯槽に係る防液堤の外面から防災作業のために必要となる距離の内側には、液化ガスの漏洩又は火災等の拡大を防止する上で支障のない設備以外の設備を設置してはならない。
2. 導管を施設し、又は、貯槽の全部又は一部を地盤面に埋設する場合にあつては、設備に損傷を与えるおそれのある場所又はガス若しくは液化ガスの漏洩若しくは火災等による危害を生ずるおそれがある場所において、これをしてはならない。

#### 第 115 条：液化ガス設備の材料

1. 液化ガス設備に属する容器及び管の耐圧部分に使用する材料は、最高使用温度及び最低使用温度において材料に及ぼす化学的及び物理的影響に対し、安全な化学的成分及び機械的強度を有し、かつ、難燃性を有するものでなければならない。
2. 貯槽及びガスホルダーの支持物の材料は、供用中の荷重に対し、十分な機械的強度及び化学的強度を有するものでなければならない。

#### 第 116 条：液化ガス設備の構造

液化ガス設備の耐圧部分又は貯槽、ガスホルダー及び導管に係る支持物及び基礎の構造は、供用中の荷重並びに最高使用圧力、最高使用温度又は最低使用温度において発生する最大の応力に対し安全なものでなければならない。この場合において、それぞれの部分に生ずる応力は当該部分に使用する材料の許容応力を超えてはならない。

#### 第 117 条：安全弁等

1. 液化ガス設備に属する容器には、過圧を防止するために適当な安全弁を設けなければならない。この場合において、当該安全弁は、その作動時に安全弁から吹き出されるガスによる危害が生じないように施設しなければならない。
2. 貯槽には、負圧による破壊を防止するため、適切な措置を講じなければならない。

#### 第 118 条：ガスの漏洩対策

液化ガス設備には、当該設備からのガス又は液化ガスが漏洩した場合の危害を防止するため適切な措置を講じなければならない。

#### 第 119 条：静電気除去

液化ガスを通ずる液化ガス設備であって、当該設備に生ずる静電気により引火するおそれがある場合にあつては、当該静電気を除去する措置を講じなければならない。

#### 第 120 条：防消火設備

液化ガス設備（可燃性ガス、可燃性液化ガス、酸素若しくは液化酸素又は毒性ガス若しくは毒性液化ガスを通ずるものに限る。）には、その規模に応じて適切な防消火設備を適切な箇所に設けなければならない。

#### 第 121 条：計測装置

液化ガス設備には、設備の損傷を防止するため使用状態を計測する装置を設けなければならない。

### 第 122 条：警報及び非常装置

1. 液化ガス設備には、使用に支障を及ぼすおそれのある、ガス又は液化ガス及び制御用機器の状態を検知し警報する装置を設けなければならない。
2. 液化ガス設備には、使用中に生じた異常による危害の発生を防止するため、その異常が発生した場合にガス又は液化ガスの流出及び流入を速やかに遮断する装置を適切な箇所に設けなければならない。
3. 外部強制潤滑油装置を有する圧送機には、当該装置の潤滑油の圧力が異常に低下した場合に圧送機を自動的に停止できる装置を設けなければならない。

### 第 123 条：遮断装置

液化ガス設備の主要なガス又は液化ガスの出口及び入口には、ガス又は液化ガスの流出及び流入を遮断するための装置を設けなければならない。

### 第 124 条：ガスの置換

1. 液化ガス設備のガス又は液化ガスを通ずる部分は、不活性ガス等でガス又は液化ガスを安全に置換できる構造でなければならない。
2. 毒性ガスを廃棄する場合には、安全に廃棄できる構造でなければならない。

### 第 125 条：表示

貯槽及びガスホルダー又はこれらの附近には、その外部から見やすいように貯槽又はガスホルダーである旨の表示をしなければならない。

### 第 126 条：耐熱装置

貯槽及びその支持物は、当該設備が受ける熱に対し十分な断熱性及び耐熱性を有する構造とし、又は当該設備の規模に応じて適切な冷却装置を設けなければならない。

### 第 127 条：防護措置

1. 液化ガス設備には、設置された状況により損傷又は腐蝕を生ずるおそれがある場合にあっては、当該設備の損傷又は腐蝕を防止することができる防護措置を講じなければならない。
2. 掘削により周囲が露出することとなった導管であって、当該設備の損傷によりガスが流出し、危害を生ずるおそれがあるものにあつては、危急の場合に当該部分にガスの流入を速やかに遮断することができる措置を講じなければならない。

## 第 128 条：気化器の加熱部

1. 液化ガス用気化器の加熱部は直火で加熱する構造のものであってはならない。
2. 液化ガス用気化器であって、加熱部の温水が凍結するおそれがあるものにあつては、凍結を防止する措置を講じなければならない。

## 第 129 条：附臭措置

導管によりガス（可燃性ガス又は毒性ガスに限る。）を輸送する場合にあつては、原則として、容易に臭気によるガスの感知ができるようにガスに附臭しなければならない。ただし、ガスの空気中の混合容積比率が千分の一未満の場合に臭気の有無が感知できるガスにあつては、この限りでない。

## 4-7 ガス化炉設備

### 第 130 条： 離隔距離

1. ガス化炉設備は、その外面と発電所の境界線との間に、ガスの漏洩又は火災等による危害を防止するために、保安上必要な距離を有するものでなければならない。
2. ガス化炉設備は、その外面から住居の用に供する建築物、または、学校、病院、市場、駅等、多数の者を収容する施設、もしくは重要な文化財等との間に、ガスの漏洩又は火災等による危害を防止するために、ガスの許容濃度、及びガス化炉設備のガス処理能力により定められる距離を有するものでなければならない。

### 第 131 条： 保安区画

ガス化炉設備は、ガスの漏洩又は火災等による危害を防止するために、設備の種類及び規模に応じ、保安上適切な区画に区分して設置し、かつ、設備相互の間には保安上必要な距離を有するものでなければならない。

### 第 132 条： ガス化炉設備の材料

ガス化炉設備に属する容器及び管の耐圧部分に使用する材料は、最高使用温度において材料に及ぼす化学的及び物理的影響に対し、安全な化学的成分及び機械的強度を有するものでなければならない。

### 第 133 条： ガス化炉設備の構造

ガス化炉設備の耐圧部分の構造は、最高使用圧力又は最高使用温度において発生する最大の応力に対し安全なものでなければならない。この場合において、耐圧部分に生ずる応力は当該部分に使用する材料の許容応力を超えてはならない。

#### 第 134 条： 安全弁

ガス化炉設備であって過圧が生ずるおそれのあるものにあつては、その圧力を逃がすために適当な安全弁を設けなければならない。この場合において、当該安全弁は、その作動時に、安全弁から吹き出されるガスによる危害及びガス化炉設備の過熱が生じないように施設しなければならない。

#### 第 135 条： 給水装置

1. ガス化炉設備に属する容器には、ガス発生量が最大状態である時の連続運転時において、熱的損傷が生ずることのないよう水を供給できる給水装置を設けなければならない。
2. 設備の異常等により当該容器に損傷が生ずることのないよう、予備の給水装置を設けなければならない。

#### 第 136 条： 蒸気及び給水の遮断

1. ガス化炉設備に属する容器の蒸気出口（安全弁からの蒸気出口及び再熱器からの蒸気出口を除く。）は、蒸気の流出を遮断できる構造でなければならない。
2. ガス化炉設備に属する容器の給水の入口は、給水の流路を速やかに自動で、かつ、確実に遮断できる構造でなければならない。

#### 第 137 条： ガス化炉設備の水抜き装置

ガス化炉設備に属する容器には、水の濃縮を防止し、及び水位を調整するために、水を抜くことができる装置を設けなければならない。

#### 第 138 条： ガスの漏洩対策

ガス化炉設備には、当該設備からのガスが漏洩した場合の危害を防止するため適切な措置を講じなければならない。

#### 第 139 条： 静電気除去

可燃性ガスを通ずるガス化炉設備であつて、当該設備に生ずる静電気により引火するおそれがある場合にあつては、当該静電気を除去する措置を講じなければならない。

#### 第 140 条： 防消火設備

ガス化炉設備（可燃性ガス、毒性ガス又は酸素を通ずるものに限る。）には、その規模に応じて適切な防消火設備を適切な箇所に設けなければならない。

#### 第 141 条： 計測装置

ガス化炉設備には、設備の損傷を防止するため運転状態を計測する装置を設けなければならない。

#### 第 142 条： 警報及び非常装置

1. ガス化炉設備には、運転に支障を及ぼすおそれのあるガスの状態を検知し警報する装置を設けなければならない。
2. ガス化炉設備には、運転中に生じた異常による危害の発生を防止するため、その異常が発生した場合にガスの流出及び流入を速やかに遮断する装置を適切な箇所に設けなければならない。

#### 第 143 条： ガスの置換

ガス化炉設備のガスを通ずる部分は、不活性ガス等でガスを安全に置換できる構造でなければならない。

### 4-8 可燃性の廃棄物を主な原材料として固形化した燃料の貯蔵設備

#### 第 144 条： 湿度測定装置

可燃性の廃棄物を主な原材料として固形化した燃料（以下「廃棄物固形化燃料」という。）の非開放型構造の貯蔵設備にあつては、当該燃料に含まれる水分を適切に維持することができるよう、湿度を連続的に測定し、かつ、記録するための装置を設置しなければならない。ただし、廃棄物固形化燃料が異常に発熱し、又は可燃性のガスが発生するおそれがない場合は、この限りでない。

#### 第 145 条： 温度測定装置

廃棄物固形化燃料の非開放型構造の貯蔵設備にあつては、熱を発生する機器がある場所の周辺及び異常な発熱を検知できる箇所に、温度を連続的に測定し、かつ、記録するための装置を設置しなければならない。ただし、廃棄物固形化燃料が異常に発熱し、又は可燃性のガスが発生するおそれがない場合は、この限りでない。

#### 第 146 条： 気体濃度測定装置

廃棄物固形化燃料の非開放型構造の貯蔵設備にあつては、可燃性のガスが発生するおそれがある箇所においてこれらのガスの濃度が爆発下限界の値に達しないよう、酸素及び一酸化炭素、メタンガスその他可燃性のガスの濃度を連続的に測定し、かつ、記録するための装置を設置しなければならない。

ただし、廃棄物固形化燃料が異常に発熱し、又は可燃性のガスが発生するおそれがない場合は、この限りでない。



#### **第 147 条： 燃焼防止装置**

1. 廃棄物固形化燃料の非開放型構造の貯蔵設備にあつては、異常な発熱又は可燃性のガスの発生が検知された場合にこれらの抑制のために十分な量の窒素その他不活性ガスを速やかに貯蔵設備の内部に封入するための装置を設置しなければならない。ただし、廃棄物固形化燃料が異常に発熱し、又は可燃性のガスが発生するおそれがない場合は、この限りでない。
2. 前項の貯蔵設備にあつて換気装置を設置する場合には、新たな酸素の供給により燃焼が促進されないように設置しなければならない。

#### **第 148 条： 消火装置**

廃棄物固形化燃料の貯蔵設備にあつては、廃棄物固形化燃料が燃焼した場合に適切に消火するための装置を設置しなければならない。

### **4-9 火力発電用電気設備**

#### **第 149 条： 可燃性のガス等により爆発する危険のある場所における施設**

可燃性のガス又は引火性物質の蒸気、もしくは粉じんが存在し、点火源の存在により爆発するおそれがある場所に施設する電気設備は、通常の使用状態において、当該電気設備が点火源となる爆発又は火災のおそれがないように施設しなければならない。

#### **第 150 条： 特別高圧の電気集じん応用装置等の施設**

使用電圧が特別高圧の電気集じん装置、及びこれに特別高圧の電気を供給するための電気設備を屋外に設置する場合には、当該電気設備の充電部の危険性を考慮して、感電又は火災のおそれがないように施設しなければならない。

#### **第 151 条： 電気防食施設の施設**

電気防食施設は、他の設備に電食作用による障害を及ぼすおそれがないように施設しなければならない。

#### **第 152 条： パイプライン等の電熱装置の施設の禁止**

パイプライン等（導管等により液体の輸送を行う施設の総体をいう。）に施設する電熱装置は、粉じんや腐食性のガス等により絶縁性能等が劣化することによる危険のある場所、もしくは可燃性のガス等により火災や爆発が起こる危険のある場所には、施設してはならない。ただし、感電、爆発又は火災のおそれがないよう、適切な措置を講じた場合は、この限りでない。

#### 4-10 雑則

##### 第 153 条： 特種設備の安全性

火力を原動力として電気を発生するために施設する設備であって、前条までに規定するもの以外のものにあつては、当該設備に及ぼす化学的及び物理的作用に対し、安全なものでなければならない。

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# **National Safety Requirements for Electric Power Facilities**

## **Part 1 General Rules**

### **Chapter 1 Purposes**

#### **Article 1: Purposes**

The National Safety Requirements articulates the technical requirements related to the safe installation and maintenance of the electric power facilities for the following purposes:

1. Prevention of Electric Shock or Fire

Requires the installation of electric power circuit, grounding equipment for electric power facilities, etc. in order to prevent from electric shock or fire.

2. Prevention of Abnormalities and Protective Measures

Articulates the fundamental concept for prevention of abnormalities of electric power facilities and which protective measures to use in response.

3. Prevention of Electric and Magnetic Obstacles

Requires the prevention of electric and magnetic obstacles caused by electric power facilities.

4. Prevention of Power Supply Failure

Requires the prevention of power supply failure caused by damage of electric power facilities.

5. Installation of Electric Power supply facilities that satisfy above 1 – 4.

Based on the safety principle, technical requirements are stipulated for safety based on the kind of electric power facilities.

National Safety Requirements stipulates the fundamental concept of safety for electric power facilities. Conforming to the National Safety Requirements, electric power facilities are installed and maintained based on such standards

as the SNI (including PUIL), IEC, etc. as the detailed methods of facility installation and maintenance, or other forms of guideline for facility installation and maintenance.

## **Chapter 2 Coverage**

### **Article 2: Coverage**

Decisions are applied to any and all activities of the electric power supply business excepting the following areas.

- Activities related to nuclear power facilities
- Activities related to wind power facilities
- Activities related to photovoltaic facilities
- Activities related to hydropower facilities other than facilities designated under article 57 pertaining to the coverage of hydropower facilities
- Activities related to thermal power facilities other than facilities stipulated under article 85 regarding the coverage of thermal power facilities

## **Chapter 3 Definitions**

### **Article 3: Terminology**

- (1) "PUIL2000" refers to the Mandatory standard of general requirements governing electrical installation in Indonesia
- (2) The substation refers to the specific outside location where outside-transmitted electricity is retransmitted after undergoing transmutation via on-site transformers, rotary converters, rectifiers and other electric machinery.
- (3) "Power Station" refers to the site where generators, motors, and other machinery are installed for the purpose of electricity generation.
- (4) The "Communication line" refers to the wire used for communicating and includes the optical fiber cable.

### **Article 4: Classification of Voltage**

- (1) Low voltage: voltages of 1,000 V or less.
- (2) Medium voltage: voltages over 1,000 V, but not more than 20,000 V.
- (3) High voltage: voltages over 20,000 V, but not more than 230,000 V.

(4) Extra-high voltage: voltages over 230,000 V.

## **Chapter 4 Safety Principles**

### **[Prevention of Electric Shock or Fire]**

#### **Article 5: Prevention of Electric Shock or Fire at Electric Facilities**

Electric power facilities shall be installed so as to not cause any electric shock, fire, or other potential danger and/or damage to people and/or properties.

#### **Article 6: Insulation of Electric Power Circuit**

1. The electric power circuit shall be insulated from the ground. Insulation resistance shall satisfy the stipulation articulated in PUIL 2000.
2. The Electric power circuit shall maintain enough insulation strength according to its voltage level in consideration of a potential abnormal voltage occurring in the event of trouble.
3. The insulation performance between coils inside the current transformer installed for the purpose of meter reading / protective devices shall be considered so that the circuit will not cause any danger resulting from an insulation breakdown if an abnormal voltage occurs in the event of trouble.

#### **Article 7: Prevention of Electric Conductor Breakage**

Wires (including electric conductor, stays, ground wires, communication lines, or other lines) shall be properly installed so as to prevent disconnection during normal operations.

#### **Article 8: Electric Conductor Connections**

Electric conductors shall be connected so that the electric resistance of the conductor at the connection point is not increased, that the insulation performance does not decrease and/or disconnect during normal operations.

#### **Article 9: Thermal Strength of Electric Equipment**

Electrical equipment installed in the electric circuit shall be able to withstand self-generated heat during normal operations.

**Article 10: Prevention of Danger in Medium-, High-, or Extra-High Voltage Electrical Equipment**

1. Medium-, high- or extra-high voltage electric equipment shall be installed so as to prevent people other than operators from easily coming into physical contact with it.
2. High- or extra-high voltage switches, circuit breakers, lightening arresters, and other similar devices, which may generate arc discharge during their operation, shall be installed at a predetermined distance away from the wooden walls, ceilings, or other combustible articles so as to prevent fires, unless they are separated by a fire-resistant material.

**Article 11: Grounding of Electrical Equipment**

Grounding shall be conducted or other appropriate measures shall be taken at necessary sections inside the electrical facilities so as to prevent any electric shock, fire, or other potential harm and/or damage to people and/or properties due to abnormal voltage rises.

**Article 12: Grounding Method for Electrical Equipment**

Grounding for the electrical facilities shall be arranged so that the current can pass safely and securely through to the ground.

**[Prevention of Abnormality and Protective Measures]**

**Article 13: Prevention of Transformer Fires at Medium-, High- and Extra High-Voltage Power Circuits**

Transformers connected between the primary side of electric power circuits (medium-, high- and Extra High- voltage) and the secondary side of electric power circuits (low-voltage) shall grounded at appropriately determined points of the transformer concerned to prevent damage to the electrical facilities at the secondary side, electric shock, or fire resulting from contact with Medium-, high- and Extra High- voltage.

**Article 14: Protective measures against Over-Current faults**

The electric power circuit shall be provided with protection against over-current faults or other appropriate measures at necessary points so as to protect the electric conductor and electric equipment from overheating and burning caused by over-currents and to prevent fires.

**Article 15: Protective measures against Ground fault**

The electric power circuit shall be accompanied with ground fault protective devices or other appropriate measures so as to prevent any damage to the electric wires and/or electric equipment due to electric shock or fire in the event of unexpected ground subsidence.

**[Prevention of Electric or Magnetic Obstacles]**

**Article 16: Prevention of Electric or Magnetic Interference in Electric Facilities**

Electrical facilities shall be installed so that they do not cause any electric or magnetic interference to the function of other electrical facilities or other properties. Therefore the level of electric/ magnetic interference shall adhere the limits as stipulated in the associated technical standard.

**[Prevention of Power Supply Failures]**

**Article 17: Prevention of Failures in Power Supply caused by Electric facilities**

Medium- or High- voltage electrical facilities for power supply and utilization shall be installed so that if they become inoperable due to damage, their loss will not be a major obstacle to power supply flow being provided by the electric power utility.

**[Prevention of Pollutions]**

**Article 18: Prevention of Pollutions**

In order to prevent pollution, electric power facilities shall comply with the regulations pertaining to environmental protection in Indonesia.

## **Part 2 Installation of Electric Power facilities for Power Supply**

### **Chapter 1 Power Network Facilities**

#### **1-1 Electric Network Facilities for Power supply**

##### **[Prevention of Electric Shock or Fire]**

##### **Article 19: Prevention of Electric Shock or Fire at Power Network**

Electric lines shall be installed so as to prevent electric shock, fire or health problems to the people or facilities surrounding the corresponding network.

##### **Article 20: Prevention of Electric Shock Caused by Overhead Electric Wires and Underground Electric Wires**

1. For low-, medium-, high- or extra-high voltage overhead electric wires, insulated electric wires or cables having insulation performance corresponding to the voltage shall be used so as to prevent electric shocks.
2. For underground electric wires (referring to electric wires of underground electric lines; this shall apply hereafter), cables having insulation performance corresponding to the voltage shall be used so as to prevent electric shocks.

##### **Article 21: Restricting Substation Entry to Operators**

At substations, switchyards, or other similar sites where medium-, high- or extra-high-voltage electric machinery or buses are installed, signs shall be installed to notify people other than operators that the electric machinery, buses, and the like are hazardous. At the same time, appropriate physical measures shall be taken to prevent unauthorized persons from easily entering the premises.

##### **Article 22: Prevention of Overhead Electric Power Line Pole/Tower Climbing**

Appropriate measures shall be taken for the supports at the overhead electric power lines to prevent unauthorized persons from easily climbing them and receiving a potentially dangerous electric shock.

##### **Article 23: Height of Overhead Electric Wires**

1. Overhead electric wires shall be installed at a height that will not cause electric shocks due to contact or induction and will not obstruct traffic.



2. Stays shall be installed at a height that will not obstruct traffic.

**Article 24: Protect workers from electrocution caused by overhead conductors connected to wires installed by others**

1. Supports of the overhead electric power lines shall not be installed between electric wires and/or communication lines installed by others.
2. Overhead electric wires shall not be installed at the sandwiching supports of the overhead electric power lines, or at the overhead communication lines that have been installed by others.

**Article 25: Prevention of Electric Shock by Electrostatic or Electromagnetic Induction from Overhead Electric Power Lines**

1. Overhead electric power lines with medium-, high- or extra-high voltage shall be installed so that the electric field strength at 1 m from the ground surface is 5 kV/m or less, and that the electricity is diminished to the point where its presence cannot be felt by people due to a continuous static induction effect. Hence, they should be installed in fields, forests, or other places where only a few people come and go so as to prevent any harm to humans.
2. Overhead electric power lines with medium-, high- or extra-high voltage shall be installed so that they do not harm human bodies via their electromagnetic induction effect through communication lines (except for communication equipment utilized for maintenance).

**[Prevention of danger to other conductors or objects]**

**Article 26: Prevention of abnormal contact of Electric Wires**

When electric wires are close to or cross other electric wires or communication lines, or are installed on the same support as the other wires, they need to be installed so that they do not damage other electric wires or communication lines and do not cause any electric shock or fire due to abnormal contact resulting from physical touching or breakage.

**Article 27: Prevention of Danger to Other Structures Caused by Electric Wires**

When electric wires are close to or cross other structures or plants, they shall be installed so that they do not damage other structures or plants and do not cause any electric shocks or fire resulting from contact or disconnection.

**Article 28: Prevention of Danger to Other Electric Wires and Structures Caused by Arc Discharge in the event of Underground Electric Wire Failure**

When underground electric wires, electric wires installed along flanks, electric wires in tunnels, and other electric wires fixed to certain structures are close to or cross other electric wires, communication lines or tubes (referred to as “other wires;” this shall apply hereafter in this Article.), they shall be installed so that they do not damage other wires by arc discharge in the event of any failure.

**Article 29: Danger Prevention at Overhead Electric Wires Due to Abnormal Voltage**

1. If medium-, high- or extra-high-voltage overhead electric wires and low- or other class voltage overhead electric wires are installed on the same support, grounding shall be made or other appropriate measures shall be taken so that the electrical installations at the low or other class voltage ends are not damaged by incoming high voltages in the event of such an abnormality.
2. If low-voltage electric machinery is installed to its support above the electric wire of the medium-, high- or extra-high-voltage overhead electric power line for railcars, grounding shall be made or other appropriate measures shall be taken so as not to cause any faults at the electrical installations at the low-voltage end by incoming high voltage in the event of such an abnormality.

**[Prevention of danger caused by collapse of supports]**

**Article 30: Prevention of Collapse of Supports (Towers/Poles)**

1. Materials and structures of the supports for overhead electric power lines or overhead electric power lines for railways (including those related to the applicable stays when stays are installed) shall be arranged safely and prevent falling in consideration of the tensile load of electric wires supported by the applicable supports, wind pressure load, as well as meteorological changes, vibrations, shocks, or other external environmental influences usually assumed at the applicable installation site.
2. Supports of medium-, high- or extra-high-voltage overhead electric power lines shall be installed so that they would not fall via a chain reaction, by designing a safe structure or employing other means.

**[Prevention of danger caused by high pressurized gas]**

**Article 31: Prevention of Danger Caused by Gas Insulated Facilities**

Compressed air devices used in gas insulated devices and switches or circuit

breakers installed at substations, switchyards, or other similar sites shall be installed as follows.

- (1) Materials and structures of the section subject to pressure shall be able to sufficiently resist the maximum pressure used and the materials themselves shall be safe.
- (2) The air tank of the compressed air device shall be anti-corrosive.
- (3) If the pressure rises, the compressed air device shall have a function that lowers the pressure before it reaches the maximum pressure used.
- (4) The compressed air device shall have a function that automatically restores the pressure when the pressure in the main air tank lowers.
- (5) The compressed air device shall have a function that detects abnormal pressure at an early stage.
- (6) Insulation gas used in the gas-insulated device shall not be combustible, corrosive, or toxic.

**[Prevention of dangerous installations]**

**Article 32: Installation Restrictions of Oil-immersed Switches**

Switches, isolators, and circuit breakers using insulation oil shall not be installed at the supports of the overhead electric power line.

**Article 33: Prohibition of Electric Power Line Installation on Cliffs**

Electric power lines shall not be installed on cliffs.

**[Prevention of electric or magnetic obstructions]**

**Article 34: Preventing Communication Facility Interference**

1. Electric power lines shall be installed so as to not cause any radio wave interference that could seriously disrupt radio communication facilities.
2. Electric lines shall be installed so that they would not obstruct communications due to the induction effect on communication lines.

**[Prevention of power supply failures]**

**Article 35: Prevention of Obstacles in Power Supply Caused by Damage to Substation Facilities**

1. Fuel cells or storage batteries for normal service shall be provided with a device which, in the event of any abnormality that could largely damage applicable electric machinery or seriously obstruct general electricity utility power supply at the applicable electric machinery, automatically blocks it from the electric power circuit.
2. For medium-, high- or extra-high-voltage transformers or phase modifier equipment, appropriate measures such as installation of a certain device shall be taken so that, in the event of any abnormality that could largely damage the electric machinery or might seriously obstruct general electricity utility power supply, such abnormalities are automatically blocked from the electric power circuit.

**Article 36: Mechanical Strength of Transformers**

Transformers, phase modifier equipment, as well as the buses and insulators supporting them shall resist mechanical impact generated by short-circuit currents.

**Article 37: Installation of Substations minus All-Time Monitoring**

Substations, which are not monitored continuously at a power station (a substation) or on the premises of a power station (a substation) by a person who possesses the necessary knowledge and skills to operate a power station (a substation) shall be provided with, excluding an emergency power generator, measures to stop the system safely and securely in the event of any abnormality.

**Article 38: Protection of Underground Electric Power Lines**

1. Underground electric power lines shall be installed so that they resist the weight pressure from vehicles or other heavy objects and that they are protected from the influence of excavation work via planted signs indicating that the area has underground electric power lines laid there.
2. Fire protection measures shall be taken during the laying down of underground electric power lines to ensure a safe underground work environment.

**Article 39: Prevention of Obstacles in Power Supply from Extra-high-voltage Overhead Electric Power Lines**

1. Extra-high-voltage overhead electric power lines shall not be installed in the city area or other areas where many houses are located, unless they are installed so that damage to the applicable electric line resulting from fire in the applicable area will not seriously obstruct the general electricity utility power supply.
2. Horizontal distance between the extra-high-voltage overhead electric wire and a building shall be at least 4 m so that damage to the applicable electric wire resulting from fire at the applicable building will not seriously obstruct general electricity utility power supply.
3. When the extra-high-voltage overhead electric wire is installed below a building, roads, pedestrian bridges or other structures, the horizontal distance of separation shall be at least 4 m so that damage to the applicable electric wires caused by falling or the like of such structures will not seriously obstruct the general electricity utility power supply.

**Article 40: Installation of Lightning Arrester for Medium-voltage, High-voltage and Extra-high-voltage Electric Power Circuits**

To prevent damage to the electrical installations installed in the electric power circuit caused by lightning voltage, the following sections or other sections close to them in the applicable electric power circuit shall be provided with the lightning arrester or other appropriate measures, unless there is no damage concern of the applicable electrical installations due to lightning voltage.

- 1) Service entrances and exits for overhead electric wires at the power station, substations or other similar sites.
- 2) Medium, high and the extra-high voltage ends of the distribution transformer connected to the overhead electric power line accompanied by protective measures for safety such as installation of an over-current breaker.
- 3) The service entrance of the customer premises which receives power supply from medium-, high- or extra-high-voltage overhead electric power lines.

**Article 41: Installation of Communication Tools for security purpose**

1. Communication equipment for maintenance shall be installed among power stations, substations, switchyards, load dispatching centers (where instructions related to operation of the electric power system are provided), engineer office, and other sites which are required to prevent large obstacles in the general electricity utility power supply to assure safety.

2. Communication lines for maintenance shall be installed so that they will not damage the communication functions due to mechanical impacts, fire, and/or the like.

#### **Article 42: Securing Communication Tools in the event of Disasters**

Materials and structures of the supports where radio communication antennas or reflectors used as communication equipment for maintenance (hereinafter referred to as “Radio communication antennas” in this Article) are installed and shall be arranged so that the communication functions will not be affected due to falling in consideration of the wind pressure load. However, this provision shall not apply to the radio communication antennas utilized to monitor the situations around the electric power line and are installed on the supports of the overhead electric power line.

### **1-2 Electrical Facilities/Equipment for Electric Power Utilization**

#### **[Prevention of electric shock or fire]**

#### **Article 43: Prevention of Electric Shock or Fire caused by Wiring at Locations of Electric Power Utilization**

1. The wiring shall be installed corresponding to the situations of the installation site and voltage so that it will not cause any electric shock or fire.
2. When movable wiring is connected with electric machinery, they shall be connected so that they will not cause any electric shock or fire due to poor connections.
3. Notwithstanding the provisions in Paragraph 1 and the preceding paragraph, high- or extra-high-voltage movable wiring shall not be installed to prevent any potential harm to humans if a person comes into contact with a live wire. It is connected to the electric machinery for which connection with movable wiring is indispensable.

#### **Article 44: Electric Wires used at Location of Electric Power Utilization Prevention**

1. Electric wires used for wiring (except for bare conductors) shall have possess a sufficient amount of strength and insulation power corresponding to the situations of the installation site and voltage so that they will not serve to cause any electric shock or fire.
2. Bare conductors shall not be used for wiring.

**Article 45: Prevention of Electric Shock or Fires caused by Electrical Equipment/Appliances installed at the Locations of Electric Power Utilization**

Electric equipment in the place of electricity utilization shall be installed so that the energized part is not exposed and that it does not generate heat, which would cause fires or be a danger to humans. However, this provision shall not apply if exposure of the live wire or installation of the heating section is indispensable for usage of the electric equipment, and it is installed so as not to cause electric shock, pose any potential harm to humans or cause fire.

**[Danger Prevention from other wirings and/or obstacles]**

**Article 46: Prevention of Danger caused by Wiring to other wirings and facilities**

1. Wiring shall be installed so that, when it is close to or crosses other wiring or communication lines, it will not cause any electric shock(s) or fire(s) due to abnormal contact.
2. Wiring shall be installed so that, when it is close to or crosses water pipes, gas pipes, or other similar articles, it will not damage these structures via electric discharges and not cause electric shocks or fires via these structures due to electric leakage or discharge.

**[Protective measures against abnormalities]**

**Article 47: Protection of Wiring at Locations of Electric Power Utilization from Over-currents**

Over-current protection devices shall be installed at appropriate locations so that it prevents over-heating that could lead to a fire breaking out inside the electric facilities. When more than one over-current protection device is utilized, protection coordination between this over-current protection is required to provide main and backup protection schemes.

**Article 48: Protective measures against Ground faults at Locations of Electric Power Utilization**

Grounding fault protection devices shall be installed so that they will not cause any facility damage and prevent electric shock or fire caused by the grounding fault. Other appropriate measures shall be taken if the initial measures cannot be employed.

## **Chapter 2 Generating Facilities (General Provision)**

### **Article 49: Unauthorized Entry Restrictions**

At power stations or other similar sites where medium-, high- or extra-high-voltage electric machinery or buses are installed, signs will be planted to notify people other than the operators that the electric machinery, buses, and/or the like are hazardous. At the same time, appropriate measures shall be taken to prevent such people from easily entering the premises.

### **Article 50: Installation of Hydrogen-cooled Generators**

Hydrogen-cooled generators shall be installed as follows:

1. They shall be of an absolute airproof structure that effectively stops hydrogen leakage or does not allow air to come in.
2. The generator, tubes, and valves for hydrogen transmission shall possess sufficient amount strength to be able to resist the pressure generated in an explosion of hydrogen under atmospheric pressure.
3. They shall be designed so that if the hydrogen leaks from the shaft seal part of the generator, the leakage can be stopped or leaked hydrogen can be safely discharged outside.
4. They shall be designed so that hydrogen can be safely inputted and discharged respectively from inside and outside the generator.
5. A function to detect any abnormalities at the early stage and provide alerts.

### **Article 51: Prevention of Obstacles in Power Supply caused by Damages to Power Stations**

In the event of any abnormality that could largely damage applicable electric machinery or seriously obstruct power supply to the applicable electric machinery, generators shall be provided with a device that automatically blocks it from the electric power circuit

### **Article 52: Mechanical Strength of Generators**

1. Generators, as well as buses and insulators supporting them shall resist mechanical impacts generated by short-circuit currents.
2. Rotary section of the generator connected to the waterwheel shall resist the speed caused when the load is blocked and the rotary section of the generator connected to the steam turbine, gas turbine, or internal combustion engine



shall resist the speed achieved when the emergency speed governing device or other emergency stop device works.

3. The structure of generators shall provide sufficient mechanical strength to withstand the maximum vibration that may occur in the critical bearing or the shaft.

#### **Article 53: Installation of Power Stations minus All-Time Monitoring**

1. The following power stations shall not be installed unless they are monitored continuously by a person who possesses the necessary operational knowledge and skills and monitors at a power station or on the premises of a power station.
  - (a) Power stations that require appropriate control in trouble cases in response to the status of abnormalities for preventing possible damage to human safety and property.
  - (b) Power stations that may significantly disrupt public power supply in trouble situations.
  - (c) Power stations in which abnormalities need to be identified immediately.
2. Power stations or substations, which are not monitored continuously at a power station (a substation) or on the premises of a power station (a substation) by a person possessing the necessary power station operational knowledge and skills (a substation) shall be provided with, minus an emergency power generator, measures to stop the system safely and securely in the event of an abnormality.

#### **Article 54: Installation of Communication Tools for security purposes**

1. Communication equipment for maintenance shall be installed among power stations, substations, switchyards, load dispatching centers (where instructions related to the operation of electric power systems are provided), engineer offices, and other sites which are required to prevent large obstacles in the power supply for general electricity utilities and to assure safety.
2. Communication lines for maintenance shall be installed so that they will not damage the communication functions due to mechanical impact, fire, or the like.

#### **Article 55: Securing Communication Tools in the event of Disasters**

Materials and structures of the supports where radio communication antennas or reflectors used as communication equipment for maintenance (hereinafter

referred to as “Radio communication antennas” in this Article) are installed and shall be arranged so that the communication functions will not be affected due to falling in consideration of the wind pressure load. However, this provision shall not apply if radio communication antennas to monitor the situations around the electric power line are installed on the supports of the overhead electric power line.

#### **Article 56: Protection of Motors from Overload**

Motors (excluding those with outputs of 0.2 kW or less) installed indoors shall be provided with appropriate measures such as the installation of an over-current circuit breaker, so that a fire will not erupt due to the burning of the applicable motor due to over-currents. However, this provision shall not apply if there is no concern that an over-current might burn the motor in consideration of the motor structure or load performance.

## **Chapter 3 Hydropower Facilities**

### **3-1 General Provisions**

#### **Article 57: Scope of Application**

1. This Chapter shall apply to facilities that will be installed for generating electricity by using hydropower as motive power.
2. The following dam-types are not covered in this Chapter.
  - 1) Dams with a height of more than 15 meters and a storage capacity of more than 100,000 cubic meters.
  - 2) Dams with a height of less than 15 meters and a storage capacity of more than 500,000 cubic meters.
  - 3) Dams specified by the Dam Safety Committee (KKB)

#### **Article 58: Definition**

The meanings of the terms used in this Chapter shall be as defined in the following applicable items:

- 1) The term “waterways” includes water intake facilities, the settling basin, the headrace, the head tank, the surge tank, the penstock (meaning a facility to directly introduce water from a head tank or a surge tank (or water intake facilities in case there is no head tank or surge tank) to the water turbines; hereinafter the same shall apply), and the tailrace.
- 2) The term “design flood level” of a dam refers to the maximum water level immediately upstream of the non-overflow section of the dam when water flows down the spillway at the discharge immediately upstream of the dam expected to occur at intervals of once in every two hundred years. For a dam with a height of less than 15 m, the design flood level refers to the maximum water level immediately upstream of the dam when a flood of water flows down the dam at the discharge immediately upstream of the dam determined from the hydrological or meteorological observation data based on the river basin of the dam.

#### **Article 59: Protection Facilities**

Dams, waterways, and any other places where a person may fall shall be provided with protection equipment such as the erection of fences, walls and/or signboards alerting people of the existing danger. However, this provision does not apply to places where the general public cannot have easy access due to the land condition or other reasons.

## **3-2 Dam**

### **3-2-1 General Rules**

#### **Article 60: Dam**

Dams shall be constructed in accordance with the following items:

- 1) The structure of a concrete gravity dam shall provide safety by taking into account the river conditions including water level and flow as well as the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic force, and the uplift pressure.
- 2) The structure of a fill dam shall create safety measures by taking into account the river conditions including the water level and flow as well as the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic force, and the pore pressure.
- 3) The structure of any other dam than the ones stated in the preceding items shall be constructed safely by taking into account the river conditions including the water level and flow as well as the dead load, water pressure, and other expected loads.

#### **Article 61: Position of the Top of the Non-Overflow Section**

The position of the top of the non-overflow section in the dam body shall be over the sum of heights of the design flood level and the applicable freeboard contingent on the type of dam and the presence of spillway gates.

Freeboard for the flood water level (minimum freeboard)

$hw + ha + hi$  and yet 1 m or higher

where

$hw$  : the wave height caused by wind

$ha$  : 0.5 m if the dam has a spillway gate and 0 m if it does not

$hi$  : 1 m for a fill dam and 0 m for a concrete dam

#### **Article 62: Foundation Ground**

The foundation of a dam shall be designed to provide the strength and water-tight qualities necessary for the stability of the dam.

### **Article 63: Concrete Materials for Dams**

Concrete materials used for dams shall possess the following attributes:

- 1) Cement shall be set and become solid in a suitable manner to maintain quality.
- 2) Aggregates shall be hard and durable.
- 3) Aggregates, water, or admixtures shall not contain any acid, salt, organic material, or any mud that may prevent the proper setting of the concrete, substantially rust the reinforcing steel, or impede the adhesion between the concrete and steel reinforcement.

### **Article 64: Prevention of Water Leakage**

The dam body and its contact with the foundation ground shall be designed so that it will pose no water leakage dangers.

### **Article 65: Spillways of Dams**

1. To properly cope with floods, a spillway shall be provided on or around the dam body adhering to the following points:
  - 1) A spillway shall be provided around the dam body if the dam is a fill dam or on or around the dam body if the dam is of any other type.
  - 2) A spillway (except the gate) shall have stability against the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic force, uplift pressure, and temperature load as well as the loading by the water discharged from the spillway at the total discharge for the design flood level.
  - 3) The stress applied to the concrete structure of a spillway (except the gate) due to the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic force, uplift pressure, and the temperature load as well as the loading by the water discharged from the spillway at the discharge for the design flood level shall not exceed the maximum allowable stress of individual materials used in the concrete structure.
  - 4) Spillways shall be designed to allow for the safe discharge of water and to prevent the possibility adverse effects occurring with the dam and its surrounding areas when the water is discharged from the spillway at the discharge for the design flood level.
  - 5) Measures shall be taken to prevent something that would harm the function of the spillways from being mixed in the water.

2. Gates for the spillways specified in the preceding paragraph shall be installed possessing the following attributes:
  - 1) The gates shall be completely water-tight.
  - 2) The gate doors should easily open or close.
  - 3) Materials used for the gate doors shall possess the chemical components and mechanical properties as required by the doors.
  - 4) The stress applied to the gate doors due to the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic forces, buoyancy and the force of operating the doors shall not exceed the maximum allowable stress of individual materials used in the doors.
  - 5) No harmful vibration shall be caused by the doors.
  - 6) The doors shall be designed to have no buckling.
  - 7) The gates shall be designed to safely transfer the load applied to the gate doors to the dam body or other structure.
  - 8) The doors shall be able to be reliably stopped if a failure occurs when the door is in operation.
  - 9) Equipment that lets the operator know the operating condition of the doors shall be provided.

#### **Article 66: Water Outlet Works Other Than Spillways**

Water outlet works other than spillways shall be provided so as to prevent the possibility of having adverse effects on the dam or its vicinity.

### **3-2-2 Concrete Gravity Dam**

#### **Article 67: Strength of Dam Body**

1. The compressive stress applied to the body of a concrete gravity dam due to the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic force, and the uplift pressure shall not exceed the maximum allowable compressive stress of the individual concrete materials used.
2. The tensile stress applied to the body of a concrete gravity dam (except the parts around the non-overflow section bolstered by a steel reinforcement against the tensile stress; the same shall apply in the next paragraph) due to the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic force, and the uplift pressure shall not exceed the maximum

allowable tensile stress of the individual concrete materials used, except for cases specified in the next paragraph.

3. The tensile stress applied to the dam body of concrete gravity due to the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic force, and the uplift pressure shall not be in the perpendicular direction in the upstream end of the dam body.

#### **Article 68: Stability of Dam Body**

A concrete gravity dam should possess enough stability to withstand potential internal sliding within the dam body as well external shifts that occur on the ground base.

#### **Article 69: Construction of Dam Body**

The body of a concrete gravity dam shall be constructed in adherence to the following points:

- 1) No harmful cracks in the concrete.
- 2) The construction of the dam body shall provide safety against the stress caused by stress concentration and/or temperature variations applied to parts around any opening made in the dam body such as the gallery, water outlet works, or the penstock.

### **3-2-3 Fill dams**

#### **Article 70: Dam Body Materials**

1. The earth materials that are to be used in the body of a fill dam shall comply with the following points:
  - 1) The materials shall have the strength and water-tight qualities necessary for the stability of the dam.
  - 2) The materials shall not have expanding or shrinking characteristics that could harm the stability of the dam.
  - 3) The materials should not be capable of somehow metamorphosing into sludge.
  - 4) The materials shall not contain organic material nor be soluble in water.

2. Materials other than the earth materials used in the water impermeable wall of a fill dam shall have the water-tight qualities, strength, and durability necessary for its stability.
3. Materials other than earth materials used in parts of the dam body other than the for the water impermeable wall of the fill dam shall have the strength, durability, and permeability necessary for its stability.

#### **Article 71: Stability of Dam Body**

A fill dam shall have enough stability to withstand potential sliding within the dam body.

#### **Article 72: Installation of Dam Body**

The body of a fill dam shall be constructed adhering to the following points:

- 1) The water impervious wall of a fill dam shall meet the following requirements:
  - a) The position of the top of the water impervious wall shall be equal to or higher than the design flood level added by the applicable freeboard contingent on the presence of the spillway gate.
  - b) The water impervious wall shall not lose its imperviousness due to deformations or cracks.
  - c) There shall be no piping in the water impervious wall or at the contact points between the impervious wall and the ground foundations.
  - d) If earth materials are used for the water impervious wall, there should be no discharge of these materials from either the upstream or downstream faces of the impervious wall.
- 2) In a fill dam where almost all uniform materials are used in the dam body, the seepage line shall not intersect the downstream slope face of the dam body.
- 3) Any slope face of the dam body for a fill dam shall not be eroded by waves or rainwater.

#### **Article 73: Construction Limitations of Water Outlet Works**

No water outlet works or water channels shall be constructed in the body of a fill dam.



### **3-3 Waterways**

#### **Article 74: General**

1. Waterways shall be provided in adherence of the following points:
  - 1) Any existing possibility that the waterways may be damaged by a flood or landslide must be eliminated.
  - 2) Where there is a possibility that water may flow into a water channel at a discharge equal to or more than the design discharge, the water channel shall be able to safely drain the flow.
  - 3) Any possibility that the waterways may be substantially damaged by the inflow of drifting wood, garbage, or soil must be eliminated.
  - 4) Concrete materials used in a water channel shall comply with the points articulated in Article 63.
  - 5) Any material other than the concrete materials used in a water channel shall possess the designated chemical composition and mechanical properties required of water channels.
  - 6) Regulating gates or gate valves, if installed, shall be in accordance with the following provisions:
    - a) Regulating gates or gate valves shall be in accordance with the points articulated in paragraph 2 of Article 65 (except items 3) and 4)).
    - b) The stress applied to the doors of regulating gates or gate valves due to the dead load, hydrostatic water pressure, dynamic water pressure, seismic force, and buoyancy shall not exceed the maximum allowable stress of individual materials used.
2. For hydro facilities utilized for power generation that fall within the electrical facilities for general use, waterways shall be provided so as to be able to safely handle surplus water without disturbing any house, field, road, or other property. However, this provision does not apply to those located in a place where there the possibility of disturbance is non-existent based on the nature of the terrain and/or other conditions surrounding the facilities.

#### **Article 75: Water Intake facilities**

Water intake facilities shall be constructed in adherence of the following points:

- 1) Water intake facilities shall possess the stability to withstand the dead load, hydrostatic water pressure, dynamic water pressure, mud pressure, seismic disturbances, uplift pressure and earth pressure. The stress caused by these

loads shall not exceed the maximum allowable stress of the individual materials utilized.

- 2) Water intake facilities directly connected to the main body of a pressure headrace or penstock shall be able to maintain good inflow conditions and constructed so that there is no possibility of adverse effects occurring that will affect the water channel or water turbines.
- 3) The water intake facilities shall possess a regulating gate or gate valve except where there is no possibility that the inflow into the water channel may increase the structure's design flow or more or where the water intake facilities withdraw torrent water.

#### **Article 76: Settling basins**

Settling basins shall be constructed in adherence of the following points:

- 1) Settling basins shall have enough stability to withstand the dead load, water pressure, seismic force, and earth pressure. The stress caused by these loads shall not exceed the maximum allowable stress of the individual materials used.
- 2) Settling basins shall have the capability to allow soil that may substantially damage the downstream water channels or water turbines to settle.

#### **Article 77: Headraces**

Headraces shall be constructed in adherence of the following points:

- 1) Headraces shall have enough stability to withstand the dead load, water weight, water pressure, seismic disturbances, earth pressure, superimposed loads, wind loads, temperature loads, and external pressure. The stress caused by these loads shall not exceed the maximum allowable stress of individual materials used.
- 2) Any possibility that water leakage may adversely affect any house, field, road, or other property shall be eliminated.
- 3) For unprotected tunnels or open channels, any possibility that falling rocks may cause substantial damage to the water channel or turbines must be eliminated.
- 4) Pressure headraces shall comply with the following provisions:
  - a) A pressure headrace shall be located below the hydraulic grade line for the lowest water level in the water intake facilities and surge tank.

- b) Where the intake of torrent water merges into a pressure headrace, any possibility that the entrained air may cause substantial damage to the water channel or turbines must be eliminated.
- c) Pressure headraces shall be designed to allow easy and reliable outflow of air during water filling and easy and reliable inflow of air during water drainage.

#### **Article 78: Head Tanks**

Head tanks shall be constructed in accordance with the following points:

- 1) Head tanks shall have enough stability to withstand the dead load, water pressure, seismic force, and earth pressure. The stress caused by these loads shall not exceed the maximum allowable stress of the individual materials used.
- 2) The inlet of the main body of a penstock shall be designed to maintain good inflow conditions and to ensure that there is no possibility of the penstock or water turbines being adversely affected.
- 3) A head tank shall have the capability to safely handle surplus water when all loads are shut down. However, this provision does not apply to where all facilities except the head tank have the capability to safely handle surplus water or where the facilities specified in paragraph 2 of Article 74 fall within those specified in the exception of the said Article.
- 4) A spillway or spillway channel to be installed in accordance with the preceding point shall comply with the following provisions:
  - a) The spillway channel shall be designed to have no excessive negative pressure if the channel is a pipe type.
  - b) There shall be no possibility that the discharge of surplus water may adversely affect the spillway, spillway channel, houses, fields, or other property.
  - c) There shall be no possibility that the water level rising during the overflow of surplus water may adversely affect the headrace.

#### **Article 79: Surge Tanks**

Surge tanks shall be constructed in accordance with the following items:

- 1) Surge tanks shall have enough stability against the dead load, water's weight, water pressure, seismic force, earth pressure, wind load, and the temperature load. The stress caused by these loads shall not exceed the maximum allowable stress of the individual materials used.

- 2) The surge tanks shall be designed to have no water level acceleration variations, if such a phenomena occurs, it must be restored to its equilibrium state within a short period of time.
- 3) Any possibility that the water level variation may cause overflow or adversely affect the water channel or turbines in any of the events a) to c) listed below must be completely eliminated. However, this provision relating to overflow does not apply to where a spillway or spillway channel is provided to safely discharge surplus water in accordance with a) and b) of item 4) of Article 78.
  - a) All loads are shut down.
  - b) Loading is dramatically increased from a half load to a full load.
  - c) For a pumped-storage power station, the input is shut off.
- 4) For a surge tank in a hydropower station for frequency regulation, any possibility that the water level variation caused by frequency fluctuations in the power grid that the power station belongs to may lead to damage of other property must be completely eliminated.

**Article 80: Penstocks**

Penstocks shall be constructed in accordance with the following items:

- 1) The stress applied to a penstock of different types as listed below due to their own applicable loads as described in the following shall not exceed the maximum allowable stress of the individual materials used.

Type of penstock	Load
Exposed type	Hydrostatic water pressure, maximum water pressure rise due to a combination of the water hammer and surging, dead load of the penstock pipe, temperature load, external pressure, weight of water in the penstock, seismic disturbances, wind load, and force applied by water stream in the penstock
Rock buried type	Hydrostatic water pressure, maximum water pressure rise due to a combination of the water hammer and surging, temperature load, and external pressure
Earth buried type	Hydrostatic water pressure, maximum water pressure rise due to a combination of the water hammer and surging, earth pressure, superimposed load, temperature load, external pressure and weight of water in the penstock

- 2) The main body of a penstock shall be able to safely withstand vibration, buckling, or corrosion.
- 3) A penstock shall be located below the hydraulic grade line for the lowest water level in the head or surge tank (or in the water intake facilities if no head or surge tank exists).
- 4) Ensure that no harmful leakage shall occur.
- 5) Anchor blocks shall be in accordance with the following provisions:
  - a) Anchor blocks shall reliably secure the main body of a penstock.
  - b) Anchor blocks shall have enough stability to withstand the dead load, the weight of the main body of the penstock, its accessories and water in the penstock, force applied by the water stream in the penstock, force caused by the water pressure applied to the reducers, seismic disturbances, superimposed loads, wind loads, and temperature loads. The stress caused by these loads shall not exceed the maximum allowable stress of individual materials used.
- 6) Supports shall be in accordance with the following provisions:
  - a) Supports shall have enough stability to withstand the dead load, the weight of the main body of the penstock, its accessories and water in the penstock, seismic disturbances, superimposed and wind loads. The stress caused by these loads shall not exceed the maximum allowable stress of the individual materials used.
  - b) The bearing parts of the supports shall be designed to allow the main body of the penstock to safely and smoothly adapt during expansion or contraction.

#### **Article 81: Tailraces**

1. The provisions of Article 77 (except the provisions a) and b) of item 4)) shall also apply to tailraces. However, the term “headrace” used in the Article shall be replaced with the new term “tailrace” and the term “pressure headrace” shall be replaced with new term “pressure tailrace.”
2. The outlet of a tailrace shall have enough stability to withstand the dead load, hydrostatic water pressure, dynamic water pressure, seismic disturbances, uplift pressure, and earth pressure. The stress caused by these loads shall not exceed the maximum allowable stress of the individual materials used.
3. Surge chambers for the pressure tailrace, if installed, shall be constructed in accordance with the provisions of Article 79.

### 3-4 Turbines and Underground Power Stations

#### Article 82: Turbines and Pumps

1. Water turbines or storage pumps for a pumped-storage power station shall be constructed in accordance with the following points:
  - 1) Any possibility that the water turbines or storage pumps for a pumped-storage power station could potentially be substantially damaged by the inflow of drift wood, garbage, or soil must be completely eliminated.
  - 2) Any part subject to water pressure shall be designed to withstand the maximum water pressure that occurs when the load or input is shut off.
  - 3) Any rotating part shall be designed to withstand the maximum speed that occurs when the load or input is shut off.
  - 4) Vibration that may damage the water turbines or storage pumps shall be prevented during operation.
  - 5) A facility for quickly interrupting the inflow or outflow of water shall be provided in water turbines or storage pumps. However, this provision does not apply to where such facilities are provided in the water channel or where the rotating parts of the water turbines are structurally safe until the runaway operation of the turbines is stopped and any possibility that the water discharge to the downstream during the time may cause personal injury or property damage has been eliminated.
  - 6) Where an inlet valve is installed in a water turbine or a discharge valve is installed in a storage pump, such valves shall be in accordance with the following provisions:
    - a) The inlet valve of a water turbine or the discharge valve of a storage pump shall be in accordance with the items (except item 4)) in paragraph 2 of Article 65.
    - b) The stress applied to the gate door of the inlet valve of a water turbine or of the discharge valve of a storage pump due to the dead load, water pressure, and seismic disturbances shall not exceed the maximum allowable stress of individual materials used.
2. Oil pressure supply systems and air compressor systems intended to be used as hydro facilities for power generation shall be corrosion resistant and be durable enough to withstand pressure increases without breaking.
3. For power generation hydro facilities that fall within the category of general usage electrical facilities for hazard prevention against dangers caused by overspeed or other water turbine failures during operations, the facilities shall

have a system to automatically and reliably stop the water turbines in the event of such failures. However, this provision does not apply when the generators' capacity is below 500 kV A and the facilities that have a system for isolating the generators from the electrical circuit in the event of such a failure, are designed so that any rotating parts remain structurally safe until the runaway operation is stopped and there is no possibility that the downstream water discharge during the time may be cause for personal injury or property damage.

### **Article 83: Construction of Underground Power Stations**

Facilities that are intended to house water turbines and generators and are constructed underground shall be in adherence with the following points:

- 1) Concrete materials used in an underground power station shall be in accordance with the items of Article 63.
- 2) An underground power station shall have the stability to withstand dead loads, water pressure, seismic disturbances and earth or ground pressure. The stress due to these loads that is applied to parts of the concrete structure shall not exceed the maximum allowable stress of the individual materials used.

## **3-5 Storage and Regulating Reservoirs**

### **Article 84: Storage and Regulating Reservoirs**

Storage and regulating reservoirs shall be constructed in accordance with the following:

- 1) All possibilities of water leakage or landslides caused by the impoundment of water by installing a dam that may adversely affect houses, fields, roads, or other property must be eliminated.
- 2) Sand sedimentation shall not result in an increase in the water level of the reservoir as it may be hazardous to the dam or adversely affect the vicinity.

## **Chapter 4 Thermal Power Facilities**

### **4-1 General Provision**

#### **Article 85: Scope of Application**

This Requirement shall apply to all thermal power electrical facilities to be installed. [Including geothermal; the same shall apply hereinafter].

### **4-2 Boilers and Accessories**

#### **Article 86: Boiler Materials**

Materials used in pressure parts for a vessel or pipe included in a boiler, independent superheater, steam accumulator (together referred to as “boilers” hereinafter), or their accessories shall possess the chemical composition and mechanical strength to safely withstand possible chemical and physical impacts on the materials at the maximum working temperature.

#### **Article 87: Structure of Boilers**

The structure of pressure parts for boilers or their accessories shall as a safety measure possessing adequate durability to be able to withstand the maximum stress at the maximum working pressure or temperature. The stress applied to the pressure parts in this case shall not exceed the maximum allowable stress of the material used in the relevant parts.

#### **Article 88: Safety Valves**

Boilers and their accessories that may have overpressure shall be equipped with an appropriate safety valve to release excessive pressure. Such safety valves shall be installed so as to prevent the boilers or their accessories from overheating.

#### **Article 89: Feed Water Supply Systems**

1. Boilers shall be equipped with a feed water supply system to prevent thermal damage during operations at the maximum continuous rating.
2. Boilers shall be additionally equipped with a standby feed water supply system to prevent thermal damage to the boiler due to facility failure.



#### **Article 90: Shutting Off Steam or Feed Water**

1. The steam outlet of a boiler (excepting the steam outlet of safety valves or reheaters) shall be constructed so that it is capable of shutting off the steam outflow.
2. The feed water inlet of a boiler shall be constructed so that it is capable of quickly, automatically, and reliably shutting off the feed water inflow of feed water.

#### **Article 91: Blow Down Systems**

Circulation boilers shall be equipped with a blow down system to drain boiler water in order to prevent the concentration of boiler water and to allow for water-level adjustments.

#### **Article 92: Instrumentation**

Boilers shall be equipped with instrumentation for measuring the operating condition necessary in order to prevent facility damage.

### **4-3 Steam Turbines and Accessories**

#### **Article 93: Steam Turbine Accessory Materials**

Materials used in the pressure parts of a vessel or pipe included in the steam turbine accessories shall have a chemical composition and mechanical strength to be able to safely withstand potential chemical and physical impact on the materials at the maximum working temperature.

#### **Article 94: Structure of Steam Turbines**

1. The structure of steam turbines shall possess a sufficient amount of mechanical strength to be able to withstand the rotation speed achieved when the emergency governor is actuated.
2. The structure of steam turbines shall possess a sufficient amount of mechanical strength to be able to withstand the maximum vibration that may occur in the critical bearing or shaft.
3. Bearings used for steam turbines shall be able to stably support the operating load and shall not be subject to abnormal wear, deformation, or overheating.

4. The critical speed of a steam turbine system combined with a generator and other rotators installed on the same shaft (or of a steam turbine that is installed on a shaft different from that used for the generator or other rotators) shall not be within the range between the minimum rotation speed obtainable with the governor and the rotation speed attained when the emergency governor is actuated. However, this provision does not apply when adequate measures have been taken to prevent the vibration at critical speed from interfering with the operations of the steam turbine.
5. The structure of pressure parts for steam turbines or their accessories shall provide adequate safety to be able to withstand maximum stress at the maximum working pressure or temperature. The stress applied to the pressure parts in this case shall not exceed the maximum allowable stress of the materials used in the relevant parts.

#### **Article 95: Governors**

Steam turbines shall be equipped with a governor to automatically control the steam's flow rate into the steam turbine in order to prevent continuous fluctuation of the rotation speed or output even with load variations. Such governors shall have the capability of maintaining the rotation speed attained after the shut down of the maximum load below the original speed at which the emergency governor was actuated.

#### **Article 96: Alarm and Emergency Shutdown Devices**

1. Steam turbines shall be equipped with a vibration-detection device. This device could potentially interfere with operations and cause the alarms to be triggered.
2. To prevent hazards caused by overspeed or other failures during operations, steam turbines shall be equipped with an emergency governor and/or other emergency shutdown devices that can automatically and quickly shut off the flow of steam into the steam turbines in the event of a failure.

#### **Article 97: Pressure Relief Devices**

Steam turbines and their accessories that may have overpressure shall be equipped with appropriate pressure relief devices.

#### **Article 98: Instrumentation**

Steam turbines shall be equipped with instrumentation for measuring the operating conditions necessary to prevent facility damage.

#### **4-4 Gas Turbines and Accessories**

##### **Article 99: Materials of Gas Turbine Accessories**

Materials used in pressure parts for a vessel or pipe included in accessories of gas turbines shall have the chemical composition and mechanical strength to safely withstand potential chemical and physical impact on the materials at the maximum working temperature.

##### **Article 100: Structure of Gas Turbines**

1. The structure of gas turbines shall provide adequate mechanical and thermal strength at the rotation speed reached when the emergency governor is actuated or at the gas temperature reached when the automatic fuel shut-off system is actuated after the gas temperature has substantially increased.
2. Bearings used for gas turbines shall be able to stably support the operating load and shall not be subject to abnormal wear, deformation, or overheating.
3. The critical speed of a gas turbine system including the generator and other rotators installed on the same shaft (or of a gas turbine that is installed on a shaft different from that for the generator or other rotators) shall not be within the range between the minimum rotation speed obtainable with the governor and the rotation speed attained when the emergency governor is actuated. However, this provision does not apply to where adequate measures have been taken to prevent the vibrations at critical speed from interfering with the operations of the gas turbine.
4. The structure of pressure parts for gas turbines or their accessories as a safety measure shall be durable enough to withstand maximum stress at the maximum working pressure or temperature. The stress applied to the pressure parts in this case shall not exceed the maximum allowable stress of the materials used in the relevant parts.

##### **Article 101: Governors**

Gas turbines shall be equipped with a governor to automatically control the flow of energy into the gas turbine to prevent continuous fluctuation of the rotation speed or output even with load variations. Such governors shall have the capability of maintaining the rotation speed attained after the shut down of the rated load below the speed at which the emergency governor is actuated.

#### **Article 102: Emergency Shutdown Devices**

1. Gas turbines shall be equipped with a vibration detection device that may interfere with operations causing the alarms to trigger.
2. To prevent hazards caused by overspeed or other failures during operations, gas turbines shall be equipped with an emergency governor and/or other emergency shutdown devices that can automatically and quickly shut off the energy flow of into the gas turbines in the event of a failure.

#### **Article 103: Pressure Relief Devices**

Gas turbine accessories that may have overpressure shall be equipped with appropriate pressure relief devices.

#### **Article 104: Instrumentation**

Gas turbines shall be equipped with instrumentation for measuring the operating conditions to prevent facility damage.

### **4-5 Internal Combustion Engines and Accessories**

#### **Article 105: Materials of Internal Combustion Engine Accessories**

Materials used in pressure parts for a vessel or pipe included in the accessories of an internal combustion engine shall have the chemical composition and mechanical strength that will enable the internal combustion engine accessories to safely withstand potential chemical and physical impacts at the maximum working temperature.

#### **Article 106: Structure of Internal Combustion Engines**

1. The structure of internal combustion engines shall possess a sufficient amount of mechanical strength to be able to withstand the rotation speed achieved when the emergency governor is actuated.
2. Bearings used for internal combustion engines shall be able to stably support the operating load and shall not be subjected to abnormal wear, deformation, or overheating.
3. The structure of pressure parts for internal combustion engines or their accessories as a safety measure shall be durable enough to withstand the maximum stress at the maximum working pressure or temperature. The stress

applied to the pressure parts in this case shall not exceed the maximum allowable stress of the materials used in the relevant parts.

4. An adequate air supply inlet and exhaust outlet shall be properly provided for internal combustion engines that are installed indoors or in a place where the possibility of oxygen deficiency may occur.

#### **Article 107: Governors**

Internal combustion engines shall be equipped with a governor to automatically control the fuel flow rate into the internal combustion engine in order to prevent continuous fluctuations of the rotation speed or output even with load variations. These governors shall have the capability of maintaining the rotation speed attained after the shut down of the rated load below the speed at which the emergency governor is actuated.

#### **Article 108: Emergency Shutdown Devices**

To prevent the occurrence of hazards caused by overspeed or other failures during operation, internal combustion engines shall be equipped with an emergency governor and/or other emergency shutdown devices that can automatically and quickly shut off the fuel flow into the internal combustion engines in the event of a failure.

#### **Article 109: Pressure Relief Devices**

Internal combustion engines and their accessories that may be subject to overpressure shall be equipped with appropriate pressure relief devices.

#### **Article 110: Instrumentation**

Internal combustion engines shall be equipped with instrumentation for measuring the operating conditions necessary to prevent facility damage.

### **4-6 Liquefied Gas Facilities**

#### **Article 111: Definitions**

1. The term "Liquefied Gas" shall refer to those liquids whose saturation pressure is over 0.2MPa at normal usage temperatures, or liquids whose saturation temperature is not more than 35 degree Celsius at 0.2MPa.

2. The term "Pipe line" shall refer to pipes and accessories installed outside of the plant that are utilized to transport fuels, gas, liquefied gas and/or a fire.

#### **Article 112: Isolation Distance**

1. The location of liquefied gas facilities shall be isolated so that distance between their exterior and the boundary of the power plants is sufficient enough to prevent hazards caused by gas leakage or liquefied gas or a fire.
2. Liquefied gas facilities, such as storage tanks, carburetor systems, pumps, compressors and gas holders shall be located with a designated separation distance based on its storage capacity, processing capacity or category of gas or liquefied gas. The distance between facilities' exterior and any building made available for use as residences, or buildings which can accommodate many persons such as school buildings, hospitals, markets, train stations and/or important cultural assets in order to prevent hazards caused by gas leakage, liquefied gas and/or a fire.
3. An isolated distance necessary for safety shall be provided between liquefied gas storage tanks, gasholders, and liquefied gas storage tanks to prevent hazards caused by gas leakage of gas, liquefied gas and/or a fire.

#### **Article 113: Safety Zones**

A power plant's Liquefied gas facilities equipped with a liquefied gas carburetor system shall be divided into groups by the type and size of the facilities and installed in an appropriate safety zone in order to prevent hazards caused by gas leakage, liquefied gas, and/or a fire. An isolated distance necessary for safety shall be provided between facilities.

#### **Article 114: Installation Location of Facilities**

1. Liquefied gas storage tank facilities that are installed around the exterior of dikes must maintain a distance necessary for disaster prevention activities excepting those that will not interfere with the prevention of gas leakage, liquefied gas or fire from spreading.
2. Where pipes or the whole or part of a liquefied gas storage tank is to be installed underground, such installations shall not be made in a place where they the facilities could be subject to danger resulting in damage or where gas leakage, liquefied gas or a fire may occur.

#### **Article 115: Materials of Liquefied Gas Facilities**

1. Materials used in the pressure parts of vessels or pipes included in liquefied gas facilities shall possess the chemical composition and mechanical strength to be able to safely withstand possible chemical and physical impacts on the materials at the maximum working temperature and shall also have flame retardant properties
2. Materials of supports of liquefied gas storage tanks or gas-holders shall have sufficient mechanical and chemical strength to withstand the load during service.

#### **Article 116: Structure of Liquefied Gas Facilities**

The structure of pressure parts for liquefied gas facilities or of the supports and foundation for liquefied gas storage tanks, gas-holders, or pipes shall be as a safety measure shall be durable enough to withstand the load during service and the maximum stress at the maximum working pressure or the maximum or minimum working temperature. The stress applied to the parts in this case shall not exceed the maximum allowable stress of the materials used in the relevant parts.

#### **Article 117: Safety Valves**

1. Vessels included in liquefied gas facilities shall be equipped with appropriate safety valves to prevent overpressure. Such safety valves shall be installed so that the blow-off gas from the actuated safety valves cannot cause a hazard.
2. Liquefied gas storage tanks shall have appropriate measures to prevent ruptures that occur under negative pressure.

#### **Article 118: Gas Leakage Prevention**

Liquefied gas facilities shall have appropriate measures to prevent hazards caused by the gas leakage or liquefied gas in the facilities.

#### **Article 119: Electrostatic Removal**

In liquefied gas facilities in which liquefied gas is charged, measures shall be taken to remove the electrostatic that builds up in the facilities that may ignite the gas.

### **Article 120: Fire Prevention & Extinguishing Systems**

At liquefied gas facilities [limited to those in which combustible gas, combustible liquefied gas, oxygen or liquefied oxygen, toxic gas, or toxic liquefied gas is charged] appropriate fire prevention and extinguishing systems suitable for the size of the facilities shall be provided in appropriate locations.

### **Article 121: Instrumentation**

Liquefied gas facilities shall be equipped with instrumentation for measuring the operating conditions necessary to prevent facility damage.

### **Article 122: Alarm & Emergency Shutdown Devices**

1. Liquefied gas facilities shall be equipped with a device for detecting the presence of gas or liquefied gas and potential control equipment conditions that may interfere with the facilities' service and subsequently trigger the alarms.
2. For the purpose of hazard prevention during service failure at liquefied gas facilities, emergency shutdown devices capable of shutting off the outflow and inflow of gas or liquefied gas shall be installed at appropriate locations.
3. Gas compressors with external forced lubrication systems shall be equipped with a device that automatically stops the compressor when the compressor reaches an abnormally low lubricant level.

### **Article 123: Shut Off Devices**

Major gas or liquefied gas outlets and inlets of liquefied gas facilities shall have a device to shut off the outflow or inflow of gas or liquefied gas.

### **Article 124: Gas Replacement**

1. Parts of liquefied gas facilities in which gas or liquefied gas is charged shall be constructed so as to allow safe replacement of gas or liquefied gas with inert gas.
2. In case of disposal of toxic gas, parts of liquefied gas facilities shall be constructed to allow for safe disposal of the toxic gas.



### **Article 125: Signs**

Liquefied gas storage tanks and gas-holders shall have signs placed on their body directly or at locations where they are readily visible indicating clearly that they are liquefied gas storage tanks or gas-holders.

### **Article 126: Thermal Insulation**

Liquefied gas storage tanks and their supports shall be constructed to provide sufficient heat resistance and insulation against heat that may be applied to the facilities or shall have an appropriate cooling system suitable for the size of the facilities.

### **Article 127: Protection**

1. Liquefied gas facilities that may be subject to damage or corrosion depending on the installation conditions shall be provided with protection measures to prevent such damage or corrosion.
2. Buried piping of liquefied gas facilities shall be provided with a measure to allow for quick shut-off of the inflow of gas into the piping in the event of an emergency, provided that the surrounding areas may be exposed via an excavation, and that the piping may be damaged resulting in gas leakage leading to hazard.

### **Article 128: Heating Section of Carburetors**

1. The heating section of liquefied gas carburetors shall NOT be designed for direct fire usage for heating.
2. In the event that hot water in the heating section of liquefied gas carburetors may freeze, measures shall be taken to prevent such freezing.

### **Article 129: Odorization**

Where gas [limited to combustible or toxic gas] is transported through piping, in principle, the gas shall be odorized so that human can easily detect its presence. However, this provision does not apply to those gases whose odor can be detected by humans when the blend ratio by volume of gas in the air is less than a thousandth.

## **4-7 Gasifier Facilities**

### **Article 130: Isolation Distance**

1. The location of gasifier facilities shall be isolated so that there is enough distance between their exterior and the boundary of the power plant to prevent hazards caused by gas leakage or fire.
2. Gasifier facilities shall be located with a designated separation distance based on allowable concentration of gas and gas throughput capacity of gasifier facilities. The distance between facilities' exterior and any building made available for use as residences, or buildings which can accommodate many persons such as school buildings, hospitals, markets, train stations and/or important cultural assets in order to prevent hazards caused by gas leakage, and/or a fire.

### **Article 131: Safety Zones**

Gasifier facilities shall be divided into groups by the type and size of facilities and installed in an appropriate safety zone in order to prevent hazards caused by gas leakage or fires. A distance necessary to ensure safety shall be provided between the facilities.

### **Article 132: Materials of Gasifier Facilities**

Materials used in the pressure parts for a vessel or pipe included in gasifier facilities shall have the chemical composition and mechanical strength to safely withstand possible chemical and physical impacts on the materials at the maximum working temperature.

### **Article 133: Structure of Gasifier Facilities**

The structure of pressure parts for gasifier facilities as a safety measure shall be durable enough to withstand the maximum stress at the maximum working pressure or temperature. The stress applied to the parts in this case shall not exceed the maximum allowable stress of the materials used in the relevant parts.

### **Article 134: Safety Valves**

Gasifier facilities that may be subject to overpressure shall be equipped with appropriate safety valves. Such safety valves shall be installed so that the blow-off gas from the actuated safety valves cannot cause a hazard or

overheat the gasifier facilities.

#### **Article 135: Feed Water Supply Systems**

1. Vessels included in the gasifier facilities shall be equipped with a feed water supply system to prevent thermal damage during continuous operations at the maximum gas yield.
2. Such vessels shall be additionally equipped with a standby feed water supply system to prevent thermal damage to the vessel due to facility failure.

#### **Article 136: Shutting Off Steam or Feed Water**

1. The steam outlet of a vessel included in the gasifier facilities (excepting the steam outlet of safety valves or reheaters) shall be constructed so that it is capable of shutting off the steam outflow.
2. The feed water inlet of a vessel included in gasifier facilities shall be constructed so that it is capable of quickly, automatically, and reliably shutting off the feed water flow.

#### **Article 137: Blow Down Systems**

Vessels included in the gasifier facilities shall be equipped with a system to drain water in order to prevent the concentration of water and to allow for water level adjustments.

#### **Article 138: Gas Leakage Prevention**

Gasifier facilities shall have appropriate measures to prevent the occurrence of hazards caused by gas leakage at the facilities.

#### **Article 139: Electrostatic Removal**

For gasifier facilities in which combustible gases are charged, measures shall be taken to remove accumulated electrostatic buildup that could serve as an ignition source for gas.

#### **Article 140: Fire Prevention and Extinguishing Systems**

At gasifier facilities [limited to those in which combustible gas, toxic gas or oxygen is charged], appropriate fire prevention and extinguishing systems suitable for the size of the facilities shall be provided in appropriate locations.

**Article 141: Instrumentation**

Gasifier facilities shall be equipped with instrumentation for measuring the operating conditions necessary to prevent facility damage.

**Article 142: Alarm and Emergency Shutdown Devices**

1. Gasifier facilities shall be equipped with a gas detection device that triggers off an alarm at the presence of sudden volatile substances.
2. In gasifier facilities, to prevent hazards caused by operational failures, emergency shutdown devices capable of quickly shutting off the outflow and inflow of gas shall be installed in appropriate locations.

**Article 143: Gas Replacement**

Parts of the gasifier facilities in which gas is charged shall be constructed to allow for the safe replacement of gas with “inert gas”.

**4-8 Storage Facilities for Solid Fuel from Wastes****Article 144: Humidity Measuring Devices**

Storage facilities for solid fuel mainly from combustible wastes (hereinafter referred to as “solid fuel from wastes”) of a closed structure shall be equipped with a device for continuously measuring and recording the humidity in order to maintain the fuel’s water content at an appropriate level. However, this provision does not apply when the possibility that the solid fuel from the wastes would abnormally generate heat or produce combustible gas is non-existent.

**Article 145: Temperature Measuring Devices**

Storage facilities for solid fuel from wastes of a closed structure shall have a device for continuously measuring and recording the temperature both around the heat-generating equipment and at positions where any abnormal heat may be detected. However, this provision does not apply when the possibility that the solid fuel from wastes would abnormally generate heat or produce combustible gas is non-existent.

#### **Article 146: Gas Concentration Measuring Devices**

In storage facilities for solid fuel from wastes of a closed structure, a device for continuously measuring and recording the concentration of oxygen, carbon monoxide, methane gas, and/or other combustible gases shall be installed to prevent such combustible gas from being concentrated reaching the lower explosive limit in places where such gas may be generated. However, this provision does not apply when there the possibility that the solid fuel from wastes would abnormally generate heat or produce combustible gas is non-existent.

#### **Article 147: Ignition Prevention Device**

1. In storage facilities for solid fuel from wastes of a closed structure, a device for quickly charging a sufficient quantity of nitrogen or other inert gases into the storage facilities to suppress any abnormal generation of heat or generation of combustible gas if detected shall be installed.
2. Where a ventilator is to be installed in such storage facilities as stated in the preceding paragraph, such a ventilator shall be installed so that the additional supply of oxygen produced thereby cannot support combustion.

#### **Article 148: Fire Extinguishing Systems**

In storage facilities for solid fuel from wastes of a silo type or other closed structures, a system for properly extinguishing the fire from the solid fuel's waste shall be installed.

### **4-9 Electrical Facilities for Thermal Power Plant**

#### **Article 149: Installation at Site with Danger of Explosion by Combustible Gas**

Electrical installations installed at the site with combustible gas, flammable substance vapor or dust where an explosion may occur if conditions conducive to ignition exist, shall be installed so that they do not serve as a potential ignition source for explosions or fire during normal operation status.

#### **Article 150: Installing Extra-high-voltage Electric Dust Collection Application Devices**

Electric dust collectors needing a supply of extra-high voltage via extra-high voltage and electrical installations shall be installed outdoors so that they do not cause any electric shock or fire from the danger posed by the live part of

the applicable electrical installations.

**Article 151: Installation of Electric Anticorrosion Facilities**

Electric anticorrosion facilities shall be installed so that they do not cause any faults via stray current corrosion that is incurred at other structures.

**Article 152: Prohibition of Installation of Electric Heating Equipment for Pipelines**

Electric heating equipment for pipelines (which refers to all facilities that transport liquid using conduits or the like) shall not be installed at the sites where the danger of insulation performance deterioration due to dust/corrosive gas, or danger of fire/explosion due to combustible gas exists. However, this provision need not apply if appropriate measures are taken to prevent electric shocks, explosions, or fires.

**4-10 Miscellaneous Provision**

**Article 153: Safety of Special Facilities**

These thermal-powered facilities have been established for the purpose of generating electricity and with the exception of those specified in the preceding articles, as a safety measure shall be durable enough to withstand potential chemical and physical effects.

## 添付資料 - 3 保安規程(日本の例)

## ***Safety Rules (Japan's sample)***

- The attached is an extract of *Safety Rules* developed by Tokyo Electric Power Company, Inc., Japan's largest power utility.
- The whole *Safety Rules* also comprise more specific information as appendix, such as:
  - Organizational structure with the positioning of Engineering Manager, description of responsibilities of each section  
(refer to Attachment-1.4, Slide 19 of the presentation);
  - Basic rules of construction, operation, and maintenance  
(refer to Attachment-1.4, Slide 20 of the presentation)
- In Japanese regulation, each power utility is obliged to develop its own *Safety Rules* that include the following 15 items:
  1. Relevant laws and regulations for Safety and managerial setup for observing *Safety Rules*;
  2. Assigned duties of each department and organizational structure;
  3. Scope of work of Engineering Manager as well as detailed descriptions, his/her authority and position in the organization;
  4. Educational activities on safety for the staff;
  5. Measures for systematical1y implementing and improving safety-related works on power generating facilities;
  6. Procedures to develop, modify, approve and archive relevant documents for safety on power generating facilities;
  7. Status of abovementioned documents related to Safety Rules;
  8. Appropriate documentation/recording concerning safety;
  9. Patrol, inspection and investigation for safety;
  10. Operation and handling of electrical facilities for power utility;
  11. Procurement of equipment and services for power generating facilities;
  12. Conservation of power generating facilities that suspend operation for a long period;
  13. Measures to be taken in disaster or in other kinds of state of emergency;
  14. Periodical review of Safety Rules and necessary amendments;
  15. Other miscellaneous issues related to safety;



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# **Safety Rules**

Tokyo Electric Power Company, Inc.

## **Part 1 General Rules**

### **Article 1: Purposes**

These Safety Rules stipulate the fundamental issues concerning safety in the process of construction, maintenance, and operation of the electric power facilities (excepting nuclear power facilities) equipped by Tokyo Electric Power Company (“safety in the process of construction, maintenance, and operation of the electric power facilities” is hereinafter referred to as “safety of the electric power facilities”) on purpose to keep public safety and secure operation of electric power facilities conforming to the Electric Power Utility Law.

### **Article 2: Coverage**

These Safety Rules are applied to the safety management of any electric power facility equipped for electric power supply business (excepting nuclear power facilities) and electric power facility equipped for own use of electricity supervised together with abovementioned facilities (Those two types of facilities are hereinafter referred to as “TEPCO’s electric power facilities”) by engineering manager.

2 The liability borderlines between TEPCO’s electric power facilities and the electric power facilities equipped by the others equal to the property borderlines except the case that there is a particular agreement for liability.

### **Article 3: Alteration of Safety Rules**

These Safety Rules are to be reviewed regularly, made necessary improvements on, and altered in the cases below.

- (1) When an amendment to Electric Power Utility Law and related laws and regulations is made;
- (2) When alternation to the organization chart as attached to these Safety Rules is made;
- (3) Or whenever any necessity to alter these Safety Rules takes place;

## **Part 2 Safety and Management Structure**

### **Article 4: Observance of related ordinances**

Items mentioned below shall be surely implemented in order to observe the related laws and regulations for securing safety of construction, maintenance, or operation of electrical facilities (hereinafter referred to as “related ordinances”) and Safety Rules.

- (1) The president shall stipulate the principles of conformance to related ordinances and set up the organizational structure to observe them.

- (2) The departments responsible for executing operations shall present the related ordinances and give necessary education to its staff, referring to the basic functions stipulated in Article 5 under the principles of conformance to related ordinances.
- (3) The departments responsible for evaluating the achievement in developing rules and organizational structure and for evaluating the observation of related ordinances and regulations (hereinafter referred to as “evaluation departments”) shall carry out the evaluation and give necessary instructions and advice.
- (4) The evaluation departments shall report to the executive directors including the president on the achievement of development of rules and implementation structure and the observation of related ordinances.
- (5) The executive directors including the president shall give necessary instructions to the departments responsible for executing operations according to the report from the evaluation departments.

#### **Article 5: Basic Functions**

Persons who are in charge of the tasks related to safety securing activities in TEPCO’s electric power facilities shall make effort to secure safety in TEPCO’s electric power facilities according to their roles in order to ensure the observance to the Electric Power Utility Law, related laws, and Safety Rules.

- 2 The president shall supervise the tasks related to safety securing activities of the chief of headquarter, the department directors of headquarter, and the branch managers.
- 3 The managers of headquarter and the department directors of headquarter support the president, supervise the tasks of the general manager of Transmission & Substations Construction Center, Transmission Department of Power Network Division, related to safety securing activities, and give assistance in the tasks related to securing safety in TEPCO’s electric power facilities.

In case the department directors manage the construction, he/she shall give instructions to the subordinates to implement the tasks related to securing safety in TEPCO’s electric power facilities. He/she shall follow the instructions of the engineering manager, which are necessary to maintain the security.

- 4 The branch managers and the general manager of Transmission & Substations Construction Center, Transmission Department of Power Network Division conduct the tasks related to securing safety in TEPCO’s electric power facilities giving instructions to their subordinates. He/she shall follow the instructions of the engineering manager, which are necessary to maintain the security.
- 5 The managerial staff shall be well informed of laws related to securing safety and the Safety Rules in order to observe them and conduct the tasks bellow in cooperation with related posts.

- (1) Maintaining security of the public and the related staff

- (2) Avoiding accidents in the facilities
- (3) Following the instructions of the engineering manager, which are necessary to maintain the security.
- (4) Giving instructions to the workers under his/her supervision

6 Workers shall conduct their tasks based on laws related to securing safety and the Safety Rules to maintain the security of TEPCO's electric power facilities, following the instructions of the engineering manager which are necessary to maintain the security and inquiring their managers of any questions arising about the execution of laws related to securing safety, etc.

7 Internal auditing division (Quality and Security Audit Department) shall evaluate through its audit whether laws related to securing safety and structure are organized, the Electric Power Utility Law, related laws, and Safety Rules are observed and executed, and shall give instructions and advice for improvement. The result of the audit shall be reported to the executive including the president.

#### **Article 6: Safety Organization**

The organizational setup related to safety in TEPCO's electric power facilities, division of duties, and commands of power feeding are indicated in the attached list 1 and 2.

#### **Article 7: Selection of the Engineering Managers**

As per the Article 43 of the Electric Power Utility Law, the following engineering managers shall be selected to supervise the safety of TEPCO's electric power facilities.

- (1) Engineering Manager for Electrical Facilities
- (2) Engineering Manager for Dams and Channels
- (3) Engineering Manager for Boilers and Turbines

2 Engineering managers shall be placed in the following business units, facilities, and positions in principle, given enough responsibilities and authority. They shall be selected from staff who does not engage directly in construction, operation, and maintenance (except the engineering manager for dams and waterways). A compatible person shall be selected in case there is no one appropriate for the post, on condition that sufficient measures are taken to enable him/her to conduct the tasks as an engineering manager.

Job Title	Facilities	Positions etc.
Engineering Manager	Headquarter (Distribution Construction Center, Construction Department)	Technical Manager
	Branch Offices	Deputy Branch Manager, Department Manager, or Technical Manager
	Power System Offices (Inawashiro, Matsumoto, Shinanogawa)	Deputy General Manager or Technical Manager
	Thermal Power Office Thermal Power Plant (Hirono)	Deputy Branch Manager, Department Manager, or Technical Manager
	Thermal Power Construction Offices	Deputy General Manager or Technical Manager
Engineering Manager for Dams and Waterways	Construction Department (Construction Office)	Technical Manager
	Water Power Plant (with dams higher than 15 meters, driving channel whose pressure is more than 392kPa, surge tanks, or discharge channel)	Technical Manager of Control Office, General Control Office
	Branch offices, Power System Offices (water power plants except the listed above)	Technical Manager of Branch Offices and Power System Offices
Engineering Manager for Boilers and Turbines	Thermal Power Plant	Deputy General Manager or Technical Manager
	Thermal Power Construction Office	Deputy General Manager or Technical Manager
	Island Offices	Deputy General Manager, Technical Manager, or Senior staff

**Article 8: Selection of the Assistant of Engineering Manager**

An assistant of engineering manager shall be selected, if needed, to support the tasks of engineering manager.

**Article 9: Functions of Engineering Manager**

Engineering managers shall supervise the safety in TEPCO's electric power facilities within his jurisdiction observing the laws and the Safety Rules. His/her tasks are specified as follows

- (1) Giving necessary directions, instructions, and advice in planning safety securing activities in TEPCO's electric power facilities
- (2) Giving directions, instructions, and advice to related staff if necessary for safety securing activities in TEPCO's electric power facilities
- (3) Giving instructions and Supervising in the pre-operational voluntary inspections, welding

inspections, and periodical inspections designated by law (hereinafter referred to as “mandatory self inspections”)

- (4) Attendance at the competent authorities’ inspections designated by law
- (5) Attendance at the competent authorities’ pre-operational inspections and periodical inspections designated by law, or confirming to the record of the inspections
- (6) Confirming the record predetermined to be inspected

#### **Article 10: Measures to be taken in Engineering Manager’s Absence**

A substitute who conducts the tasks of engineering manager in his/her absence (hereinafter referred to as a “substitute”) shall be preliminary appointed.

2 The substitute shall faithfully conduct the engineering manager’s tasks in his/her absence.

#### **Article 11: Measures to be taken in the Presence of Multiple Engineering Managers**

Job descriptions shall be predetermined when more than one engineering managers are to be appointed in one business establishment.

#### **Article 12: Dismissal of an Engineering Manager**

An engineering manager shall be dismissed in case of a transfer, a retirement, or in the event of any of the following events.

- (1) Said engineering manager is regarded as incompetent acting against the laws and the Safety Rules.
- (2) Said engineering manager is regarded as incompetent because of a long-term business trip, an absence due to sickness, and so on.

#### **Article 13: Arrangement of an Administrator for Security Control**

An administrator for security control shall be arranged to be in charge of evaluation, instruction, and giving advice for improvement of TEPCO’s structure including rules related to safety securing activities in TEPCO’s electric power facilities.

### **Part 3 Education of Safety**

#### **Article 14: Contents and Measures of Education**

Education and training covering the following contents shall be provided to staff that are engaged in safety securing activities in TEPCO’s electric power facilities in order to maintain safety.

- (1) Items related to compliance with the Electric Power Utility Law, other concerned laws, and Safety Rules
- (2) Items that contribute to acquiring and improving knowledge, techniques, and skills of safety securing activities in TEPCO’s electric power facilities.
- (3) Items related to measures to be taken in case of accidents and emergencies, its drills,

and its trainings.

(4) Other items necessary for safety

2 Education programs to systematically implement the abovementioned education of safety shall be arranged, periodical evaluations of the effect of education and corresponding improvement in the programs conducted in parallel.

## **Part 4 Installation and Alteration of Electrical Facilities**

### **Article 15: Confirmation of Notification**

Regarding installation and alteration of electrical facilities, procedures shall be stipulated to confirm whether the construction is required a notification of the construction plan by the Electric Power Utility Law, and if the notification is required, whether the proper procedures have been taken in conformity to the Electric Power Utility Law.

## **Part 5 Patrols and Inspections**

### **Article 16: Implementation of Patrols and Inspections**

To maintain safety in TEPCO's electric power facilities, the following patrols and inspections shall be carried out, their results recorded as described to Article 28 and preserved for the required period.

- (1) The patrols and inspections referred to in the attachment 3 shall be carried out in the purpose of maintaining TEPCO's electric power facilities as they comply with the laws and preventing accidents.
- (2) Necessary patrols and inspections shall be carried out in case of accidents or any probable accidents.
- (3) Necessary patrols and inspections shall be carried out in order to confirm the safety and compliance with safety requirements in or after the process of construction of TEPCO's electric power facilities.

### **Article 17: Implementation of Mandatory Self Inspections**

Regarding TEPCO's electric power facilities that are required to have mandatory self-inspections, appropriate inspections shall be conducted following the properly established and documented procedures. Responsible persons necessary for each inspection shall be appointed to give instructions, supervise the inspection, and record the results to be preserved for the required period following Article 28.

2 In case the mandatory self-inspection is to be outsourced, conditions such as scope of work and measures of inspection shall be clarified in the specifications. Inspections of electrical facilities for power generation and likewise for the rest of the electrical facilities shall be judged their compliance with the specifications following Article 27.

### **Article 18: Countermeasures for the Results of Patrols and Inspections**

In the event of detection of issues that violate safety requirements or need improvements to secure safety as a result of patrols and inspections of TEPCO's electric power facilities, emergency procedures shall be taken immediately followed by the study and implementation of permanent countermeasures.

## **Part 6 Operation of Electrical Facilities**

### **Article 19: Basic Operation**

TEPCO's electric power facilities shall be operated to expend all possible means to maintain sustainable power supply even in the abnormal circumstances regarding the following items.

- (1) TEPCO's electric power facilities shall be operated properly with appropriate measures or procedures such as securing safety based on adequate knowledge of functions and handling methods of the equipment.
- (2) In case of mutually related operations at power plants and substations, said operation shall be handled based on the instructions of power feeding except in emergencies.

2 Regarding the instructions of power feeding in the preceding article, the following items shall be considered.

- (1) The group that is in charge of the instruction of power feeding shall have close contact with related groups to recognize the current situations of the power s.
- (2) Instructions of power feeding shall be communicated accurately and promptly from the responsible group to the operating group.

### **Article 20: Operation in Dams**

Operation in dams over the height of fifteen meters shall follow Article 47 in River act.

### **Article 21: Countermeasures in case of Accidents and other Abnormal Circumstances**

In case of accidents or probable accidents in TEPCO's electric power facilities, current situations shall be reported immediately to the related groups and proper countermeasures shall be taken.

2 In case of accidents in TEPCO's electric power facilities, the following countermeasures shall be taken.

- (1) Emergency measures shall be taken to prevent the damage from expanding and efforts for early restoration shall be made.
- (2) The causes shall be probed as soon as possible to prevent the recurrence of the accident.

### **Article 22: Countermeasures in case of Disasters or other Emergencies**

Countermeasures to secure safety of TEPCO's electric power facilities against typhoons, floods, storm surges, earthquakes, tsunamis, heavy snows, conflagrations shall be taken



following Article 39 of Disaster Countermeasure Basic Act, Article 6 of Act on Special Measures concerning Countermeasures against Large-scale Earthquake, Article 6 of Act on Special Measures concerning Promotion of Measures against Earthquake Disaster in the Tonankai and Tokai areas, and Article 6 of Act on Special Measures concerning Promotion of Measures against Earthquake Disaster in the Surrounding Area of Japan Trench and Chiyoda Trench.

#### **Article 23: Securing Safety in case of Shutdown of Power Plants for a Considerable Period**

In case of shutdown of power plants for a considerable period, safety in the utility shall be maintained according to the following items.

(1) Boilers, turbines, and other major equipments shall be inspected and repaired, performing necessary procedure of dust prevention, corrosion control, moisture prevention.

(2) Disasters shall be prevented by completely disposing of the remaining fuel in the equipment.

2 In case there are facilities still in operation while certain facilities in the same power plant are to be inactive for a considerable period, both areas shall be distinctly segregated, separating the connected apparatus.

3 At the resumption of operation, equipment shall be inspected to certify safety, going through a trial operation if necessary.

### **Part 7 Improvement of Safety of Electrical Facilities for power generation**

#### **Article 24: Documents for Safety and their perspective**

Procedures of preparation, amendment, approval, preservation of documents related to construction, maintenance, or operation of electrical facilities for power generation shall be stipulated as “Administrative Provision of Rules and Manuals” .

2 Documents necessary for safety shall consist of three phases, which are Common Rules, Manuals of the Headquarters, Documents for Operation in the Branches. Manuals of the Headquarters shall basically consist of two manuals-Basic Manuals, which outline the operation at the headquarters and Operation Manuals, which precisely states each operation.

3 Basic manuals based on the Safety Rules shall be presented in attachment 5.

4 Documents necessary for safety shall be periodically reviewed and improved if necessary.

#### **Article 25: Planning and Implementation of Safety**

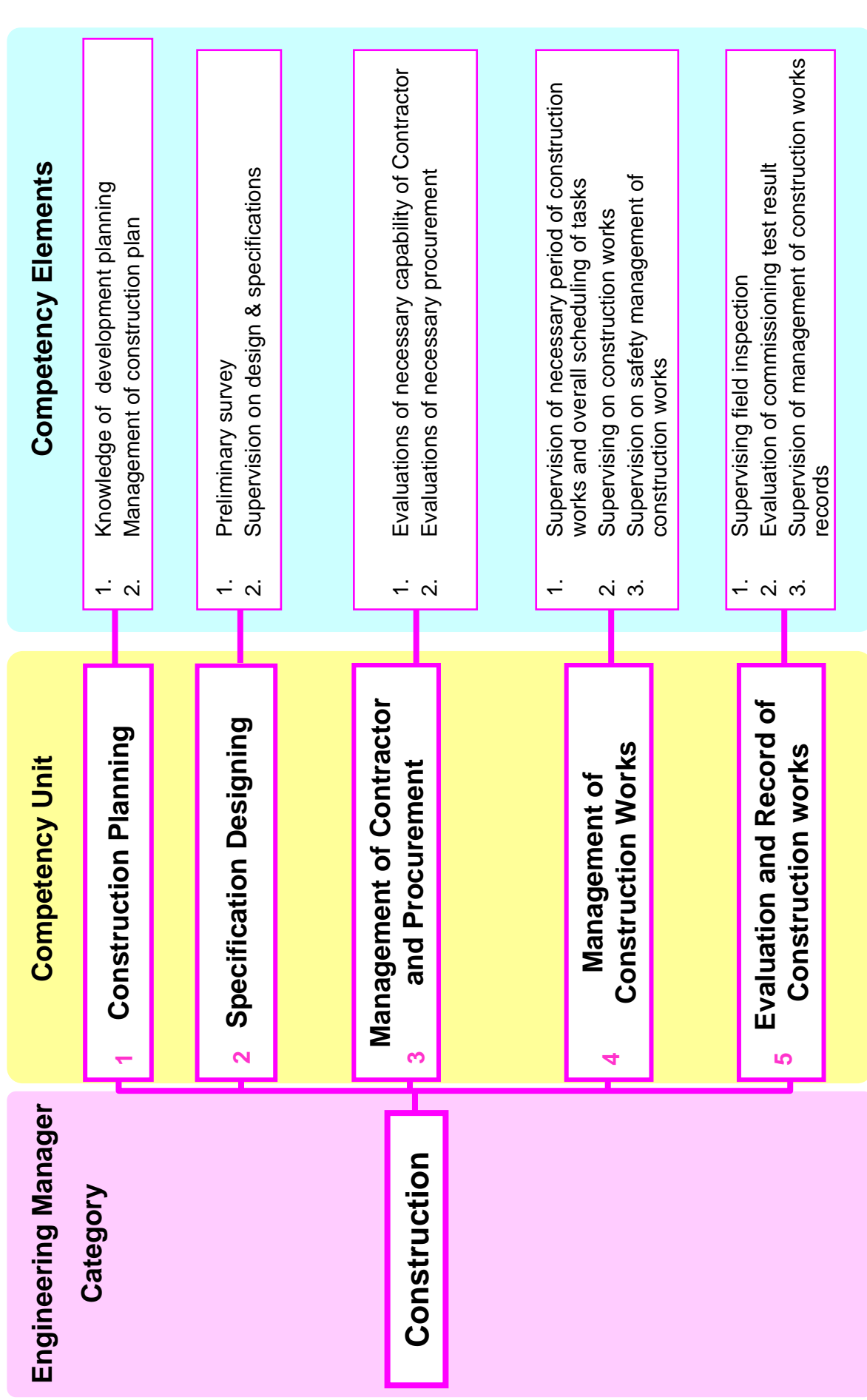
Regarding the safety related to construction, maintenance, or operation of electrical facilities for power generation, necessary plans shall be formulated to assist atic operation. When plans of operations are formulated, based on the directions (objectives) of safety rules, concrete objectives and s shall be established regarding inquiries by laws and both human and material resources.

**Article 26: Evaluation and Improvement of Safety**

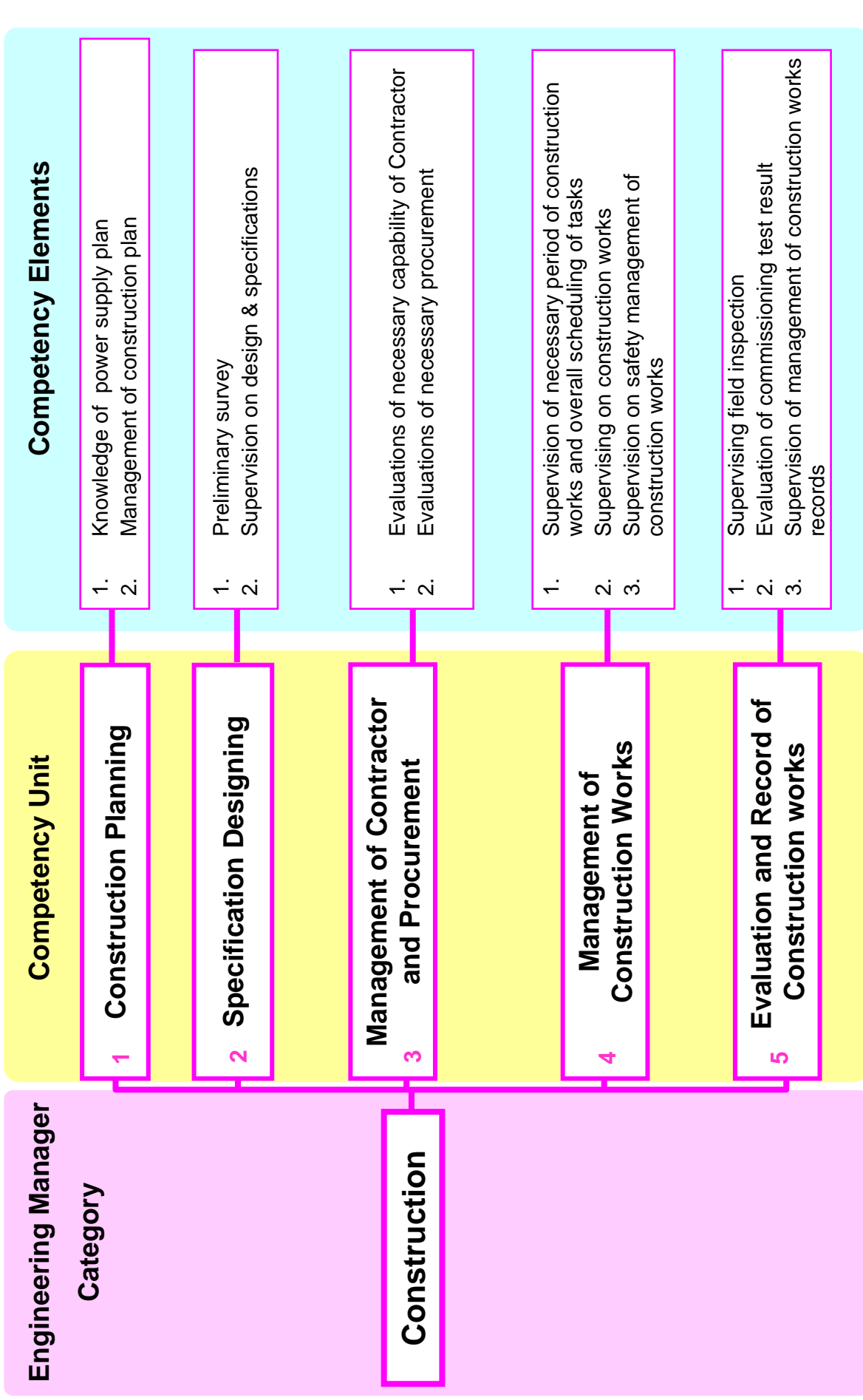
Regarding activities for safety related to construction, maintenance, or operation of electrical facilities for power generation, surveys shall be made to check whether related plans and s are adequately prepared and whether they have achieved good results in conformity to the Electric Power Utility Law, other related laws, and the Safety Rules. Improvements (including developing preventive measures) shall be made based on the evaluations of the self-inspections. In such cases, plans shall be formulated taking human and material resources into consideration.

## 添付資料 - 4 技術責任者に求められる能力要件

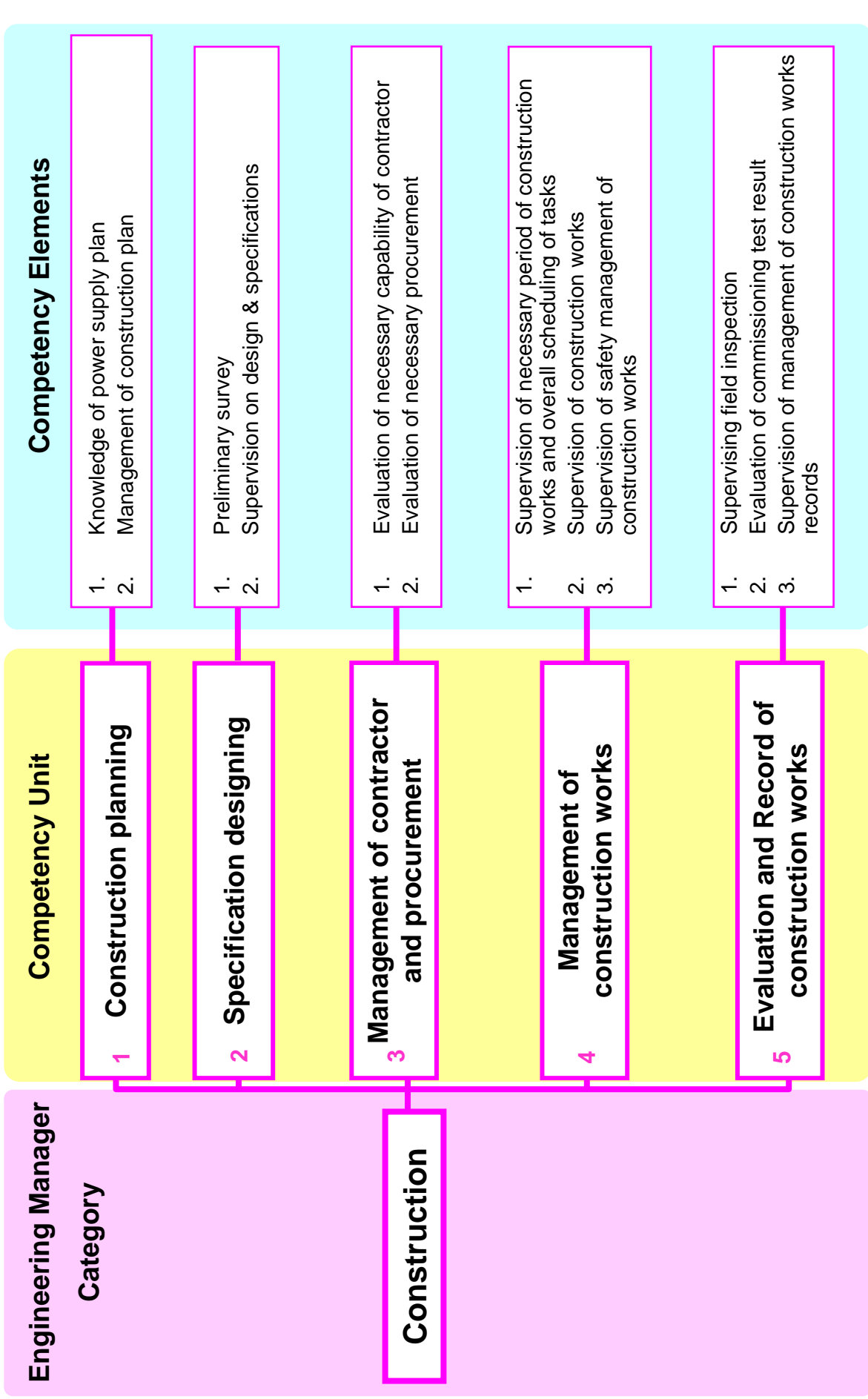
# Hydropower Generation <Civil> (Construction)



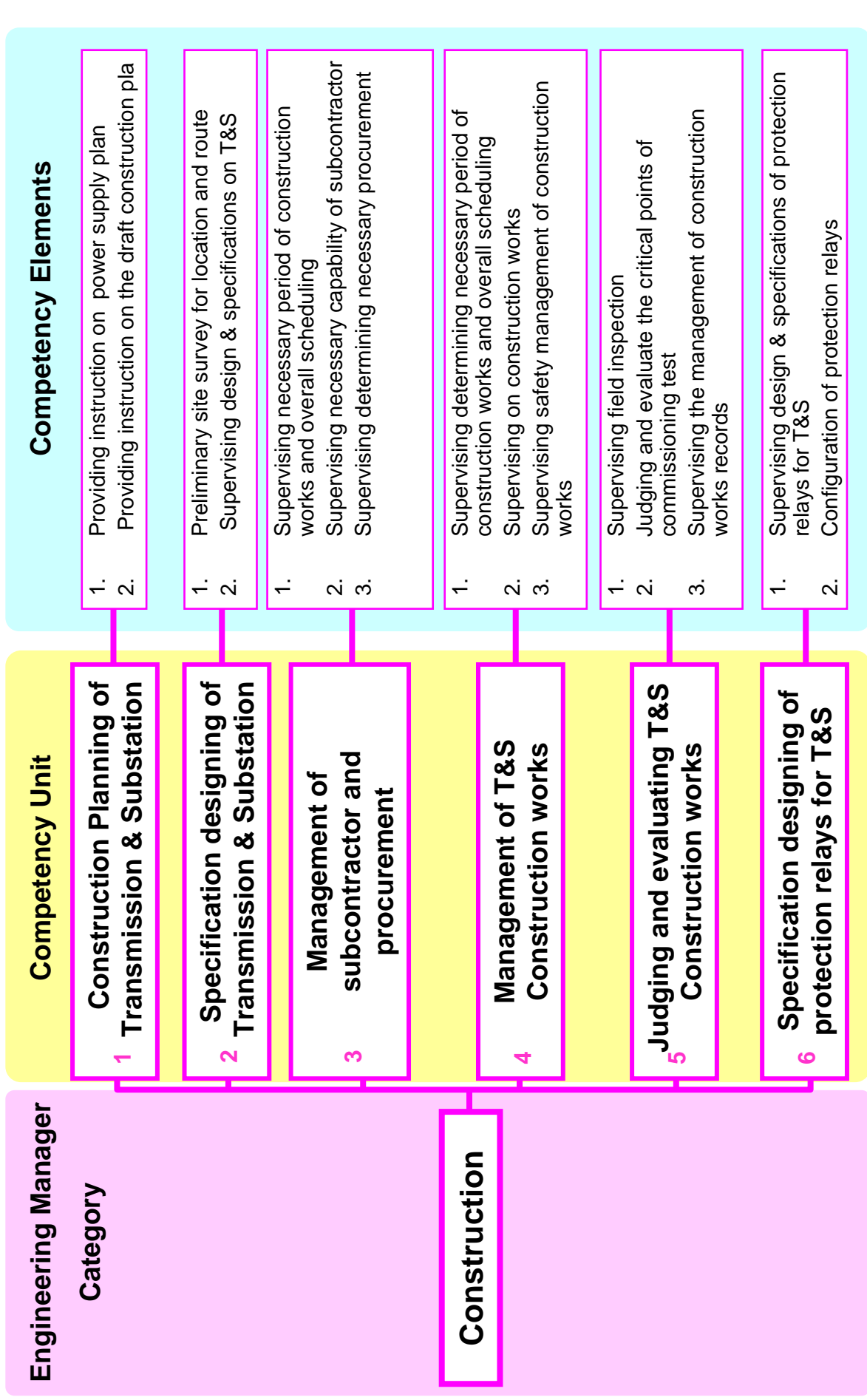
# Hydropower Generation <Mechanical & Electrical> (Construction)



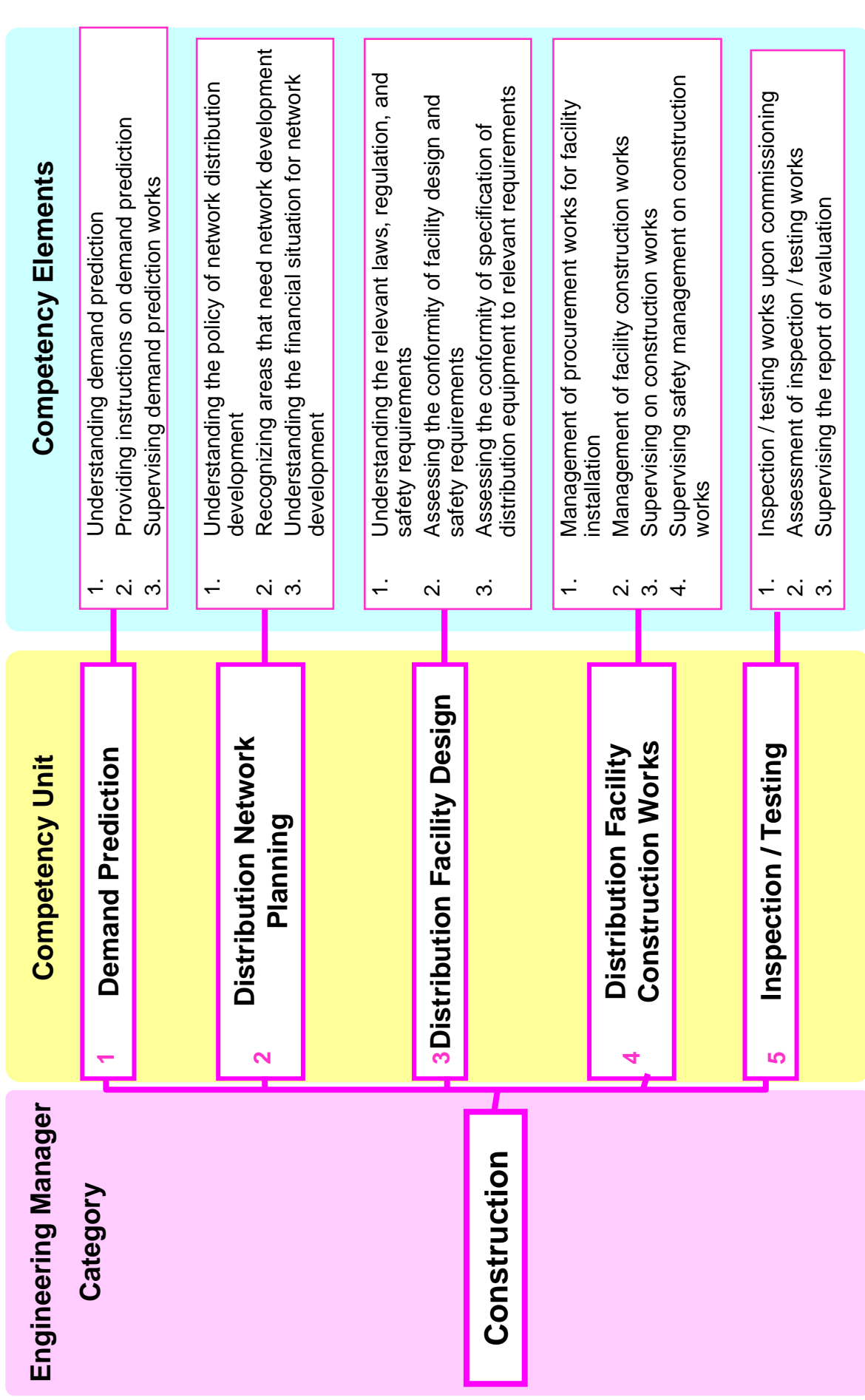
# Thermal Power Generation (Construction)



# Transmission & Substation (Construction)



# Distribution (Construction)





**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxx

Unit Name: Construction Planning of Hydropower (Civil) Plant

Description: This competency unit is related to development planning and construction planning on hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Knowledge of development planning of hydropower plant	1.1. Understanding of national power development policy 1.2. Understanding of long-term power supply schedule for demand 1.3. Understanding of overall development plan for the river concerned 1.4. Understanding of method of hydropower plant development process 1.5. Understanding of supply demand balance in the area 1.6. Knowledge of relevant divisions and organizations 1.7. Understanding of operating plan of the power plant
2. Management of construction plan	2.1. Understanding of period of construction works, total expenditure and facilities' configuration 2.2. Assessment of outline of construction plan 2.3. Knowledge of national safety requirements and relevant regulations 2.4. Knowledge of processing application of construction plan 2.5. Consideration of social and environmental issue related the project

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxxxx  
 Unit Name: Specification designing of Hydropower (Civil) Plant  
 Description: This competency unit is related to preliminary survey and supervision on design & specifications of hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Preliminary survey	1.1. Supervising on implementation of environmental impact assessment 1.2. Understanding of related regulation and environmental restrictions 1.3. Assessment of the result of environmental impact assessment 1.4. Assessment of dam, location of powerhouse and route of waterways 1.5. Providing instruction on method and route of material transportation from technical and safety point of view
2. Supervision on design & specifications	2.1. Understanding of national safety requirements and national standard 2.2. Knowledge of material characteristic 2.3. Assessment of selection of facilities in conformity to operating plan 2.4. Assessment of estimated flood discharge and spillway design for the safety 2.5. Assessment of conformity of facilities to relevant safety regulations and requirements 2.6. Assessment of design values and basis of facilities 2.7. Judgment of introduction of equipments which is adopted new technology

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxx

Unit Name: Management of Contractor and procurement for Hydropower (Civil) plant construction

Description: This competency unit is related to the evaluation of necessary capability of Contractor and necessary procurement for hydropower (Civil) plant construction.

Competency Elements	Performance Criteria
1. Evaluation of necessary capability of Contractor	1.1. Knowledge of major contractor in electrical power sector 1.2. Understanding of experience and capability of contractor in electrical power sector and civil work for dam 1.3. Providing instruction on selection of contractor
2. Evaluation of necessary procurement	2.1. Knowledge of major manufacturer in electrical power sector and civil work for dam 2.2. Understanding of manufacturer's experience and application record of materials 2.3. Providing instruction on selection of manufacturer and materials

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxx  
 Unit Name: Management of Hydropower (Civil) plant Construction works  
 Description: This competency unit is related to the supervision on construction works including overall scheduling and safety management for hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Supervision of necessary period of construction works and overall scheduling of tasks	1.1 Understanding of necessary period of construction works 1.2 Understanding of planning of scheduled maintenance works with power interruption 1.3 Supervising on progress of construction work 1.4 Knowledge of relevant divisions and organizations 1.5 Providing instruction on adjusting the deviation of the actual status from the original plan
2. Supervising on construction works	2.1. Knowledge of installation methods 2.2. Knowledge of national safety requirements 2.3. Knowledge of relevant manufacturer and construction company 2.4. Providing instruction on prior consultation for work procedure 2.5. Assessment of installation condition based on national safety requirements
3. Supervision on safety management of construction works	3.1. Understanding of relevant safety guidelines and manuals 3.2. Knowledge of safety monitoring points 3.3. Providing instruction on safety management to subordinate and constructor

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Evaluation and Records of Hydropower (Civil) Plant Construction works

Description: This competency unit is related to supervision on field inspection, evaluation of commissioning test results and records management for hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Supervising field inspection	1.1 Understanding of numerical criteria provided by safety regulations and requirements 1.2 Understanding of statutory inspection and inspection items 1.3 Understanding of inspection methods and procedures 1.4 Arrangement with supervisory authority 1.5 Providing instruction on corrective action in case of unsuitable result
2. Evaluation of commissioning test result	2.1. Understanding of national safety requirements, design value and basis 2.2. Assessment of conformity of inspection condition and results to national safety requirement and design value 2.3. Providing instruction on corrective action in case of unsuitable result
3. Supervision of management of construction works records	3.1. Understanding of necessary construction work records and period of keeping documents 3.2. Understanding of regulations and decree about records and storage 3.3. Management of construction records and proper storage

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Construction**

Distribution  
(Construction 1 )  
Demand Prediction

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Demand prediction for distribution system development

Description: This competency unit is related to the demand forecasting for distribution network expansion planning.

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Understanding the demand prediction for distribution system development	1.1 Understanding the concept of demand prediction for network planning 1.2 Understanding how the result of demand prediction is applied for network planning
2. Providing instructions regarding the demand prediction	2.1 Providing instructions on demand prediction based on the data and information prepared for distribution network planning
3. Supervising the demand prediction works for network planning	3.1 Supervising the demand prediction process 3.2 Assessing the result of demand prediction for distribution network planning

**Power Engineers Competency Standard**

**Basic Group: Distribution**

**Group: Construction**

Distribution  
(Construction 2)  
Distribution Network  
Planning

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Distribution Network Planning

Description: This competency unit is related to the knowledge, implementation capability regarding network planning.

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Understanding the distribution network planning process	1.1 Understanding the policy of distribution network development 1.2 Recognizing target areas for the development 1.3 Understanding the financial situation for network development
2. Assessing the distribution network planning	2.1 Assessing the new project of distribution network development plan 2.2 Assessing the cost and benefit analysis 2.3 Prioritizing the criteria of network development project
3. Providing instructions on distribution network planning	3.1 Providing instructions to review the project planning 3.2 Providing instructions to review the cost calculation 3.3 Providing information regarding the reasoning of project selection

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Construction**

Distribution (Construction 3) Distribution Facilities Design
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Distribution facilities design

Description: This competency unit is related to the knowledge and competency required for facility design.

Competency Elements	Descriptions of Competency Elements
1. Understanding the relevant laws, regulations, and safety requirements for facility design	1.1 Understanding the relevant laws, regulations, requirements, guidelines for facility design 1.2 Understanding the required specification to design the distribution facilities 1.3 Understanding the situation of site where distribution facility is located
2. Assessing the conformity of the design of distribution network and safety requirements	2.1 Assessing the conformity of the distribution network design to relevant laws, regulations, requirements, and guidelines. 2.2 Providing instructions about design of distribution facilities.
3. Assessing the conformity of specification of distribution equipment to relevant requirements.	3.1 Assessing the conformity of specification of distribution equipment to the relevant requirements. 3.2 Providing instructions about specification of distribution equipment



**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Construction**

Distribution (Construction 4) Distribution Facilities Construction Works
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Implementation of distribution facility construction works

Description: This competency unit is related to construction works of distribution facilities.

Competency Elements	Descriptions of Competency Elements
1. Management of procurement works for facility installation	1.1 Understanding the procurement process of construction works 1.2 Providing instructions on procurement of construction works
2. Management of facility construction works	2.1 Understanding the entire plan of construction works 2.2 Providing necessary instructions to proceed construction works appropriately 2.3 Managing the construction work scheduling
3. Supervising on construction works	3.1 Understanding basic rules for construction works 3.2 Providing instructions regarding the construction works in accordance with relevant laws / regulations
4. Supervising safety control on construction works	4.1 Understanding the basic rules for safety. 4.2 Providing instructions to proceed safe construction works 4.3 Supervising the implementation of safety construction works

**Power Engineers Competency Standard**

**Basic Group: Distribution**

**Group: Construction**

Distribution  
(Construction 5)  
Inspection and Testing

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Inspection / testing of distribution facilities upon commissioning

Description: This competency unit is related to the supervising of commissioning / inspecting / testing for construction works.

<b>Competency Elements</b>	<b>Descriptions of Competency Elements</b>
1. Inspection / testing works upon commissioning	1.1 Understanding the inspecting/testing works 1.2 Understanding the necessity of inspecting/testing works in accordance with the relevant laws/regulations
2. Assessment of inspection / testing works	2.1 Assessing the conformity of facilities to relevant laws / regulations 2.2 Providing instructions on inspection / testing procedures 2.3 Providing instructions, if necessary, to comply with relevant laws / regulations
3. Supervising the report of evaluation	3.1 Supervising the report preparation for evaluation of commissioning works 3.2 Providing instructions on report preparations

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxxxx  
 Unit Name: Construction planning of Thermal power plant  
 Description: This competency unit is related to the power supply plan and construction planning on thermal power generation

Competency Elements	Performance Criteria
1. Knowledge of power supply plan	1.1 Understanding of national power development policy 1.2 Understanding of long-term power supply schedule 1.3 Understanding of method of Thermal power plant development process 1.4 Understanding of supply demand balance in the area 1.5 Knowledge of relevant divisions and organizations 1.6 Understanding of operating plan of the power plant
2. Management of construction plan	2.1 Understanding of period of construction works, total expenditure and configuration of facilities 2.2 Assessment of outline of construction plan 2.3 Knowledge of national safety requirements and related regulations 2.4 Knowledge of processing application of constructing plan 2.5 Consideration of social and environmental issue related the project

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Construction**

Unit Cord:       xxxxxxxxxxxxx  
 Unit Name:       Specification designing of Thermal power plant  
 Description:     This competency unit is related to designing of thermal power generation

Competency Elements	Performance Criteria
1. Preliminary survey	1.1 Supervising on implementation of environmental impact assessment 1.2 Understanding of related regulation and environmental restrictions 1.3 Assessment of the result of environmental impact assessment 1.4 Assessment of route of transmission lines and fuel pipe lines 1.5 Providing instruction on method and route of material transportation from technical and safety point of view
2. Supervision on design & specifications	2.1 Understanding of national safety requirements and national standard 2.2 Knowledge of material characteristic 2.3 Assessment of selection of facilities in conformity to operating plan 2.4 Assessment of safety interlock for facilities 2.5 Assessment of conformity of facilities to relevant safety regulations and requirements 2.6 Assessment of design values and basis of facilities 2.7 Judgment of introduction of equipments which is adopted new technology

Thermal power  
(Construction 3)  
Work Management  
Contractor / Material Management

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of contractor and procurement for Thermal power plant construction

Description: This competency unit is related to the supervising capability of managing contractor and procurement.

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Evaluation of necessary capability of contractor	1.1 Knowledge of major contractor in electrical power sector 1.2 Understanding of experience and capability of contractor in electrical power sector 1.3 Providing instruction on selection of contractor
2. Evaluation of necessary procurement	2.1 Knowledge of major manufacturer in electrical power sector 2.2 Understanding of manufacturer's experience and application record of materials 2.3 Providing instruction on selection of manufacturer and materials

Thermal power  
(Construction 4)  
Work Management  
Works/Safety Management

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Thermal power plant construction works

Description: This competency unit is related to the supervising on construction works and safety management.

Competency Elements	Performance Criteria
1. Supervision of necessary period of construction works and overall scheduling of tasks	1.1 Understanding of necessary period of construction works 1.2 Understanding of planning of scheduled maintenance works with power interruption 1.3 Supervising on progress of construction work 1.4 Knowledge of relevant divisions and organizations 1.5 Providing instruction on adjusting the deviation of the actual status from the original plan
2. Supervision of construction works	2.1 Knowledge of installation methods 2.2 Knowledge of national safety requirements 2.3 Knowledge of relevant manufacturer and construction company 2.4 Providing instruction on prior consultation for work procedure 2.5 Assessment of installation condition based on national safety requirements
3. Supervision of safety management of construction works	3.1 Understanding of relevant safety guidelines and manuals 3.2 Knowledge of safety monitoring points 3.3 Providing instruction on safety management to subordinate and constructor

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxxxx  
 Unit Name: Evaluation and Record of construction works for Thermal power plant  
 Description: This competency unit is related to evaluation and record of the construction works and assessment of inspection result

Competency Elements	Performance Criteria
1. Supervision of field inspection	1.1 Understanding of numerical criteria provided by safety regulations and requirements 1.2 Understanding of statutory inspection and inspection items 1.3 Understanding of inspection methods and procedures 1.4 Arrangement with supervisory authority 1.5 Providing instruction on corrective action in case of unsuitable result
2. Evaluation of commissioning test result	2.1 Understanding of national safety requirements, design value and basis 2.2 Assessment of conformity of inspection condition and results to national safety requirement and design value 2.3 Providing instruction on corrective action in case of unsuitable result
3. Supervision of management of construction works records	3.1 Understanding of necessary construction work records and period of keeping documents 3.2 Understanding of regulations and decree about records and storage 3.3 Management of construction records and proper storage





**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical &Electrical)**  
**Group: Construction**

Unit Cord:       xxxxxxxxxxxxx  
 Unit Name:       Specification designing of Hydropower (mech. & elec.) Plant  
 Description:     This competency unit is related to preliminary survey and supervision on design & specifications of hydropower (mech. & elec.) plant.

Competency Elements	Performance Criteria
1. Preliminary survey	1.1. Supervising on implementation of environmental impact assessment 1.2. Understanding of related regulation and environmental restrictions 1.3. Assessment of the result of environmental impact assessment 1.4. Assessment of location of powerhouse and route of transmission lines 1.5. Providing instruction on method and route of material transportation from technical and safety point of view
2. Supervision on design & specifications	2.1. Understanding of national safety requirements and national standard 2.2. Knowledge of material characteristic 2.3. Assessment of selection of facilities in conformity to operating plan 2.4. Assessment of safety interlock for facilities 2.5. Assessment of conformity of facilities to relevant safety regulations and requirements 2.6. Assessment of design values and basis of facilities 2.7. Judgment of introduction of equipments which is adopted new technology

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxx

Unit Name: Management of Contractor and procurement for Hydropower (mech. & elec.) plant construction

Description: This competency unit is related to the evaluation of necessary capability of Contractor and necessary procurement for hydropower (mech. & elec.) plant construction.

Competency Elements	Performance Criteria
1. Evaluation of necessary capability of Contractor	1.1. Knowledge of major contractor in electrical power sector 1.2. Understanding of experience and capability of contractor in electrical power sector 1.3. Providing instruction on selection of contractor
2. Evaluation of necessary procurement	2.1. Knowledge of major manufacturer in electrical power sector 2.2. Understanding of manufacturer's experience and application record of materials 2.3. Providing instruction on selection of manufacturer and materials

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Construction**

Unit Code: xxxxxxxxxxxx

Unit Name: Management of Hydropower (mech. & elec.) plant Construction works

Description: This competency unit is related to the supervision on construction works including overall scheduling and safety management for hydropower (mech. & elec.) plant.

Competency Elements	Performance Criteria
1. Supervision of necessary period of construction works and overall scheduling of tasks	1.1 Understanding of necessary period of construction works 1.2 Understanding of planning of scheduled maintenance works with power interruption 1.3 Supervising on progress of construction work 1.4 Knowledge of relevant divisions and organizations 1.5 Providing instruction on adjusting the deviation of the actual status from the original plan
2. Supervising on construction works	2.1. Knowledge of installation methods 2.2. Knowledge of national safety requirements 2.3. Knowledge of relevant manufacturer and construction company 2.4. Providing instruction on prior consultation for work procedure 2.5. Assessment of installation condition based on national safety requirements
3. Supervision on safety management of construction works	3.1. Understanding of relevant safety guidelines and manuals 3.2. Knowledge of safety monitoring points 3.3. Providing instruction on safety management to subordinate and constructor

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Construction**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Evaluation and Records of Hydropower (mech. & elec.) Plant  
Construction works

Description: This competency unit is related to supervision on field inspection, evaluation of commissioning test results and records management for hydropower (mech. and elec.) plant.

Competency Elements	Performance Criteria
1. Supervising field inspection	1.1 Understanding of numerical criteria provided by safety regulations and requirements 1.2 Understanding of statutory inspection and inspection items 1.3 Understanding of inspection methods and procedures 1.4 Arrangement with supervisory authority 1.5 Providing instruction on corrective action in case of unsuitable result
2. Evaluation of commissioning test result	2.1. Understanding of national safety requirements, design value and basis 2.2. Assessment of conformity of inspection condition and results to national safety requirement and design value 2.3. Providing instruction on corrective action in case of unsuitable result
3. Supervision of management of construction records	3.1. Understanding of necessary construction work records and period of keeping documents 3.2. Understanding of regulations and decree about records and storage 3.3. Management of construction records and proper storage

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Construction**

T&S
(Construction 1 )
Construction Planning
Supply Planning

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Construction Planning of Transmission and Substation

Description: This competency unit is related to the power supply plan and construction planning on Transmission and Substation

Competency Elements	Performance Criteria
1. Providing instruction on power supply plan on T&S	1.1 Understanding national power development policy 1.2 Understanding long-term power supply schedule for demand 1.3 Understanding the method of T&S development process 1.4 Understanding supply demand balance in the area 1.5 Coordination with relevant divisions and organizations 1.6 Estimating power demand
2. Providing instruction on the draft construction plan of on T&S	2.1 Understanding construction outline such as period of construction works and total expenditure 2.2 Evaluating the draft construction plan and ordering the appropriate advise if needed. 2.3 Coordination with relevant divisions and organizations 2.4 Conducting the cost-benefit analysis 2.5 Considering social and environmental issue related the project

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Construction**

T&S
(Construction 2)
Construction Planning
Design / Survey

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Specification designing of Transmission and Substation

Description: This competency unit is related to designing of Transmission and Substation

Competency Elements	Performance Criteria
1. Preliminary site survey for location and route on T&S	1.1 Understanding variety of methods of work 1.2 Selecting appropriate area of workspace 1.3 Coordinating with relevant divisions and organizations 1.4 Analyzing proper route of transmission lines and location of substations 1.5 Negotiating with landowners in order to secure appropriate route of transmission lines and location of substations
2. Supervising design & specifications on T&S	2.1 Analyzing available transmission capacity of conductor 2.2 Analyzing strength for steel towers and foundation 2.3 Supervising on selecting appropriate substation types and suitable equipments(transformer / switchgear) 2.4 Supervising on selecting suitable connection and facility layouts 2.5 Judging the conformity of facilities to relevant safety regulations and requirements 2.6 Supervising of necessary period of construction works and overall scheduling of tasks 2.7 Judging the introduction of equipments which is adopted new technology

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Construction**

T&S (Construction 3) Work Management Contractor / Material Management
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of subcontractor and procurement

Description: This competency unit is related to the supervising capability of managing subcontractor and procurement.

Competency Elements	Performance Criteria
1. Supervising necessary period of construction works and overall scheduling of tasks	1.1 Understanding necessary period of construction works 1.2 Understanding the planning of scheduled maintenance works with power interruption 1.3 Coordinating with relevant manufacturers and construction companies 1.4 Coordinating with relevant divisions and organizations 1.5 Providing instruction for adjusting the deviation of the actual status from the original plan.
2. Supervising necessary capability of subcontractor	2.1 Understanding main subcontractor in electrical power sector. 2.2 Understanding main capability of subcontractor in electrical power sector based on subcontractor's experience. 2.3 Judging the proper subcontractor based on subcontractor's experience. 2.4 Providing instruction on assessment for evaluating subcontractor. 2.6 Providing instruction for adjusting the deviation of the actual status from the original plan
3. Supervising necessary procurement.	3.1 Understanding main manufacturer in electrical power sector. 3.2 Judging the proper manufacturer based on manufacturer's experience. 3.3 Providing instruction on assessment sheets for evaluating manufacturer.

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Construction**

T&S  
 (Construction 4 )  
 Work Management  
 Works/Safety  
 Management

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of T&S Construction works

Description: This competency unit is related to the supervising on construction works and safety management of construction works.

Competency Elements	Performance Criteria
1. Supervising necessary period of construction works and overall scheduling of tasks	1.1 Understanding necessary period of construction works 1.2 Understanding the planning of scheduled maintenance works with power interruption 1.3 Coordinating with relevant manufacturer and construction company 1.4 Coordinating with relevant divisions and organizations 1.5 Providing instruction for adjusting the deviation of the actual status from the original plan.
2. Supervising construction works	2.1 Understanding necessary period of construction works 2.2 Understanding the planning of scheduled maintenance works with power interruption 2.3 Coordinating with relevant manufacturer and construction company 2.4 Coordinating with relevant divisions and organizations 2.5 Providing instruction for subordinate 2.6 Providing instruction for adjusting the deviation of the actual status from the original plan
3. Supervising safety management of construction works	3.1 Understanding relevant safety guidelines and manuals 3.2 Supervising safety management for preventing accidents by pointing list of works 3.3 Providing instruction for subordinate and constructor



**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Construction**

T&S (Construction 5) Inspection/Evaluation
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Judging and evaluating T&S construction works

Description: This competency unit is related to the judging and evaluating the construction works and assessment capability of construction works.

Competency Elements	Performance Criteria
1. Supervising field inspection	1.1 Understanding numerical criterion provided by safety regulations and requirements 1.2 Assessing the conformity of inspection results 1.3 Providing instruction for subordinate, manufacturer and constructor 1.4 Judging the introduction of equipments which is adopted new technology 1.5 Providing appropriate instruction for solving problem, if it is not suitable results
2. Judging and evaluating critical points of commissioning test	2.1 Understanding national safety requirements 2.2 Assessing the conformity of inspection results 2.3 Judging the introduction of equipments which is adopted new technology 2.4 Providing appropriate instruction for solving problem, if it is not suitable results
3. Supervising the management of construction works records	3.1 Understanding the necessary construction works records and period for keeping documents. 3.2 Understanding the regulations and the degree about records and store. 3.3 Keeping these records and store them properly

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Construction**

T&S
(Construction 6)
Protection relays
Design

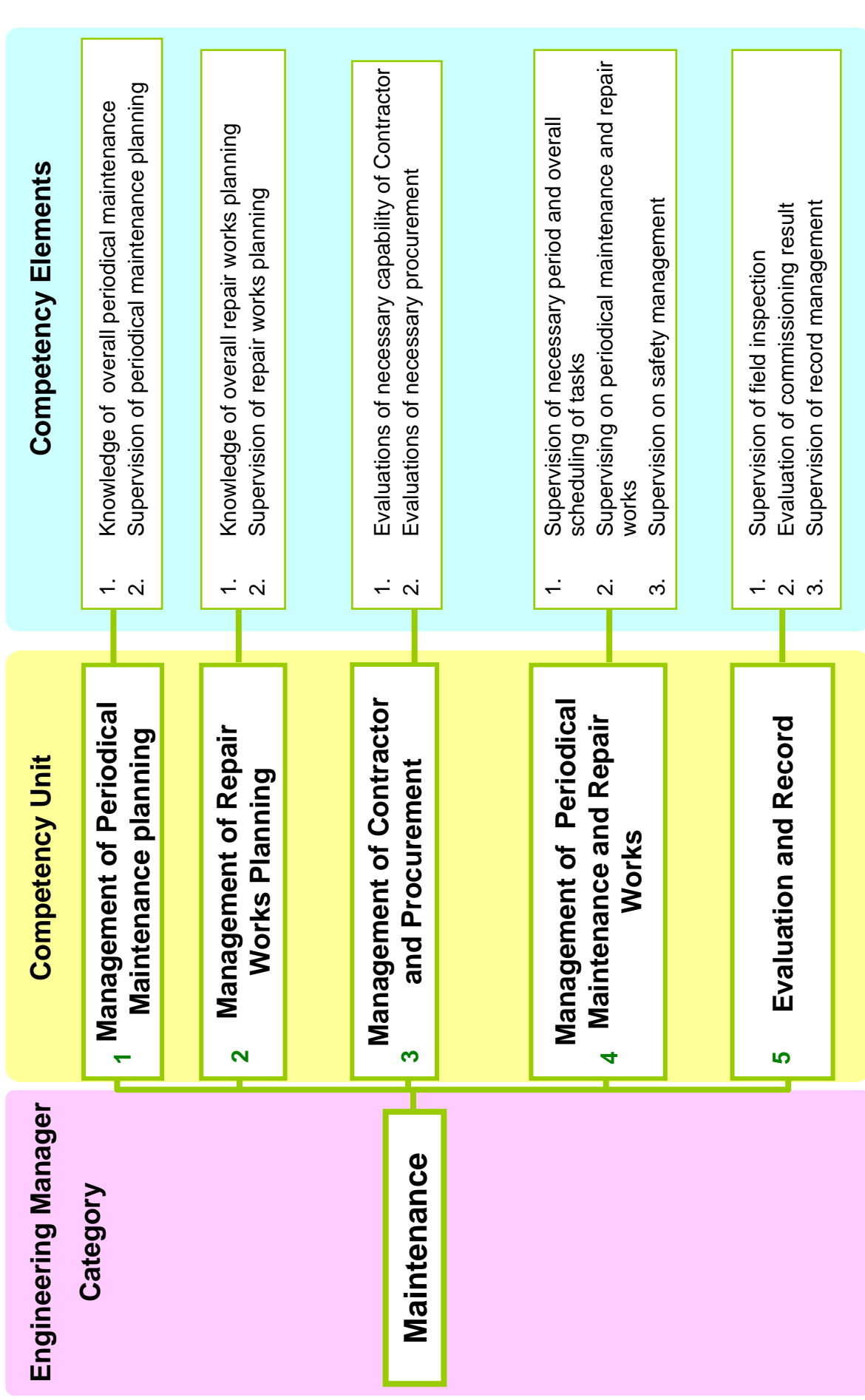
Unit Cord: xxxxxxxxxxxxxx

Unit Name: Specification designing of protection relays for T&S

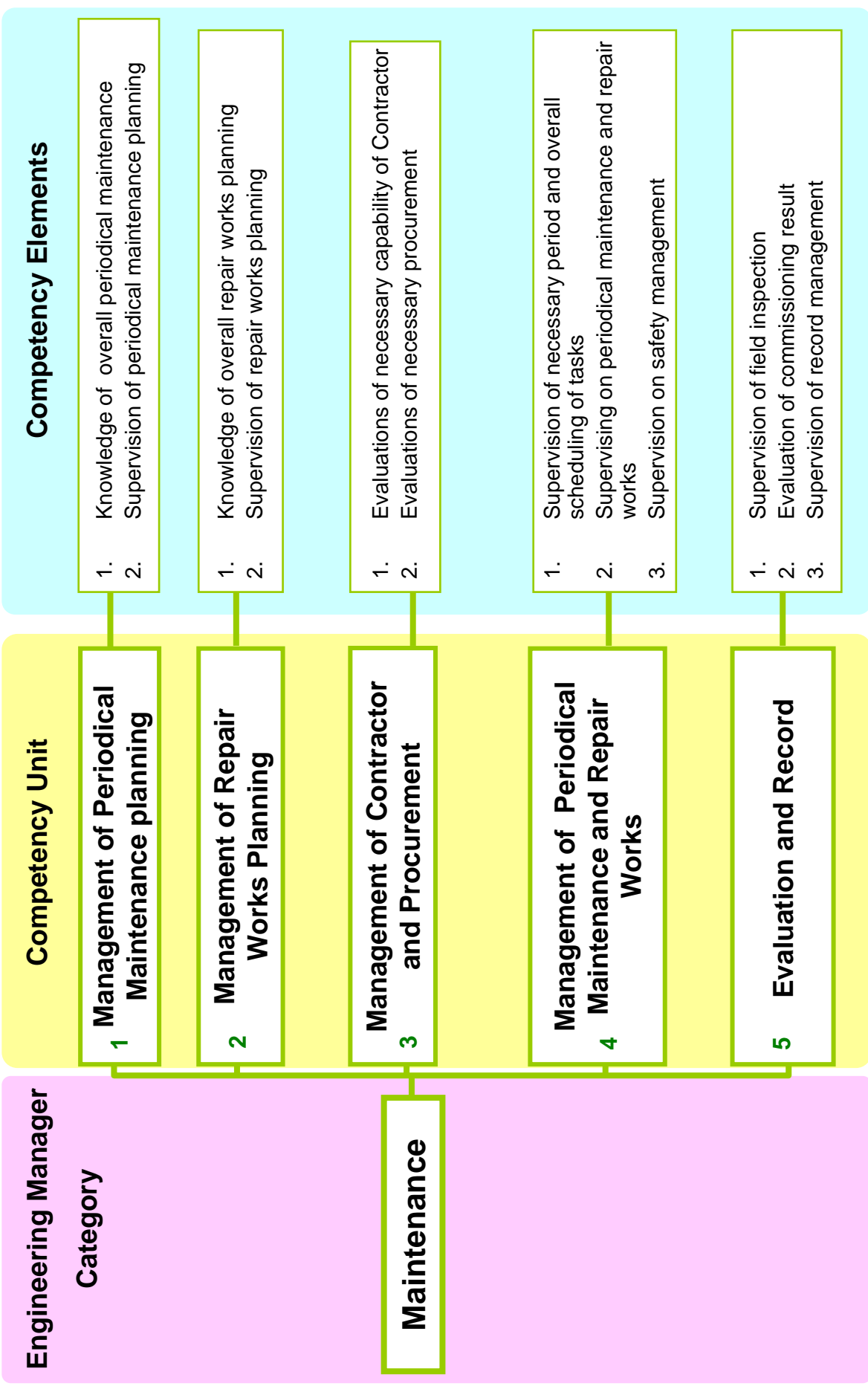
Description: This competency unit is related to the designing of protection relays for Transmission and Substation.

Competency Elements	Performance Criteria
1. Supervising design & specifications of protection relays for T&S	1.1 Understanding all types of protection relays and the specifications and functions of protection relays 1.2 Understanding zone of protection relays and the methodology of protection co-ordination 1.3 Coordination with relevant divisions and organizations 1.4 Supervising on selecting suitable protection relays 1.5 Judging the conformity of protection relays to relevant safety regulations and requirements 1.6 Supervising necessary period of construction works and overall scheduling of tasks 1.7 Judging introduction of equipments which is adopted new technology
2. Supervising configuration of protection relays	2.1 Understanding the specifications and functions of protection relays. 2.2 Supervising determining appropriate installation of protection relays taking into account coordination with other systems 2.3 Applying understanding of transformer overload and inrush current to the analysis of system fault and protection

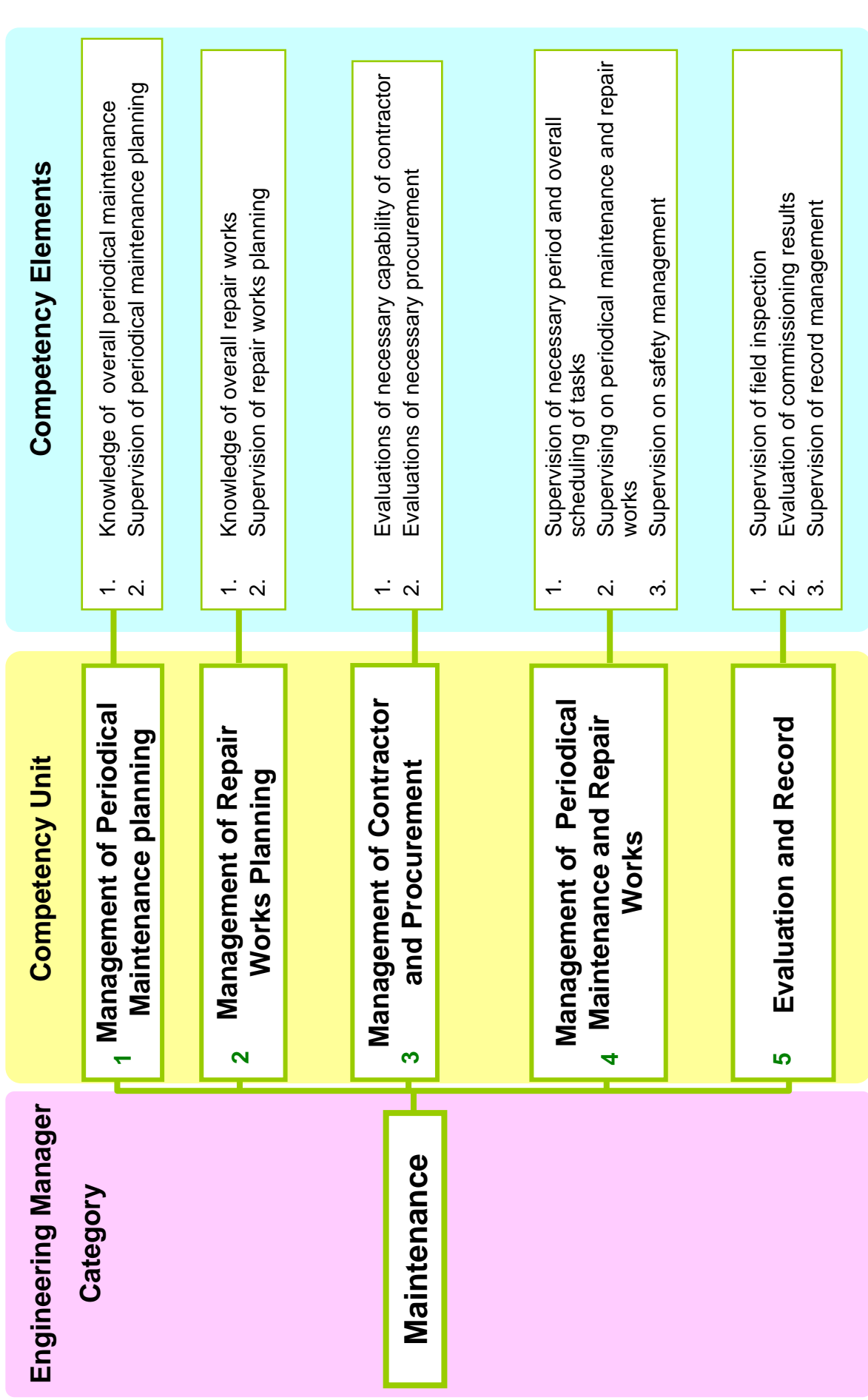
# Hydropower Generation <Civil> (Maintenance)



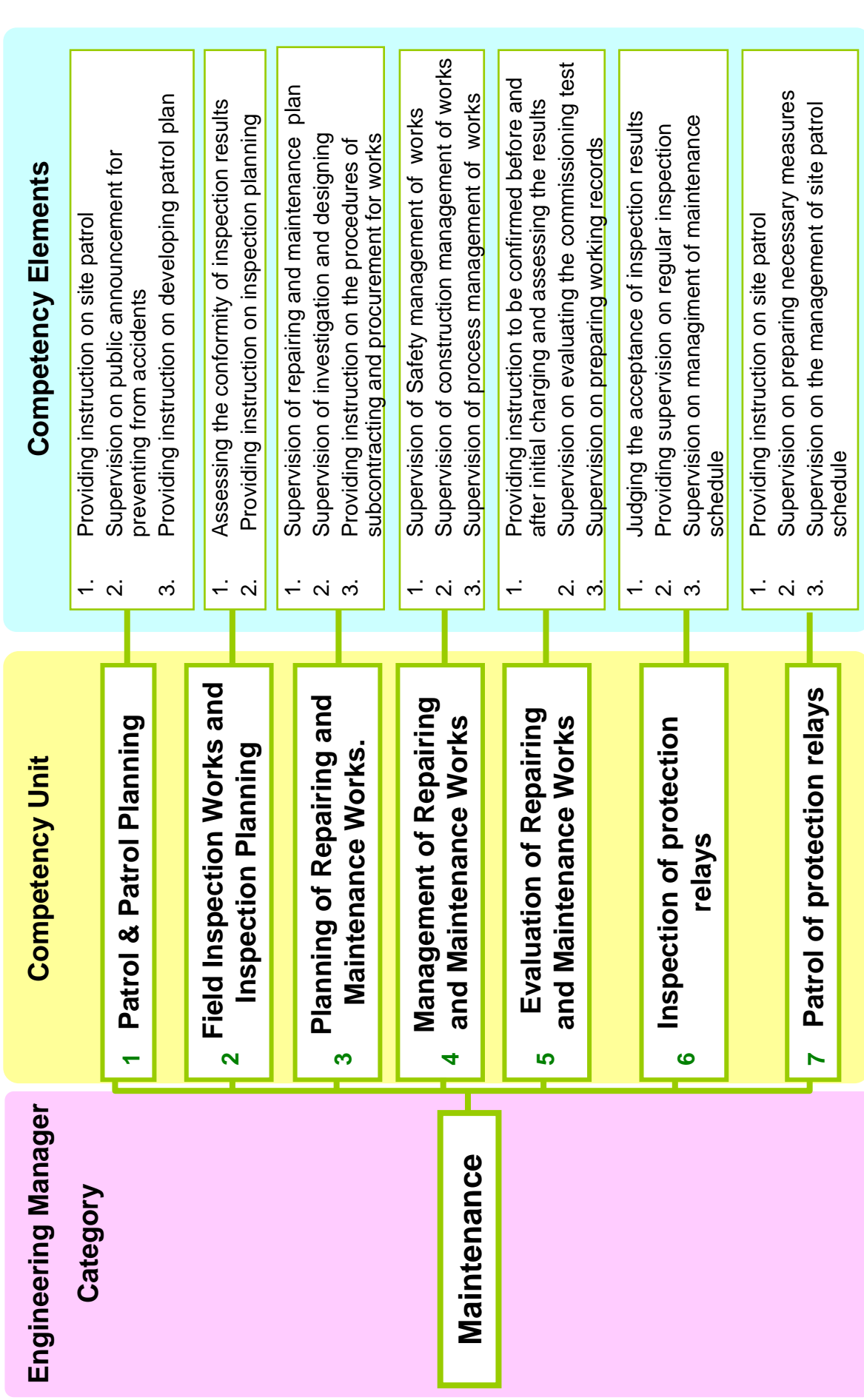
# Hydropower Generation <Mechanical & Electrical> (Maintenance)



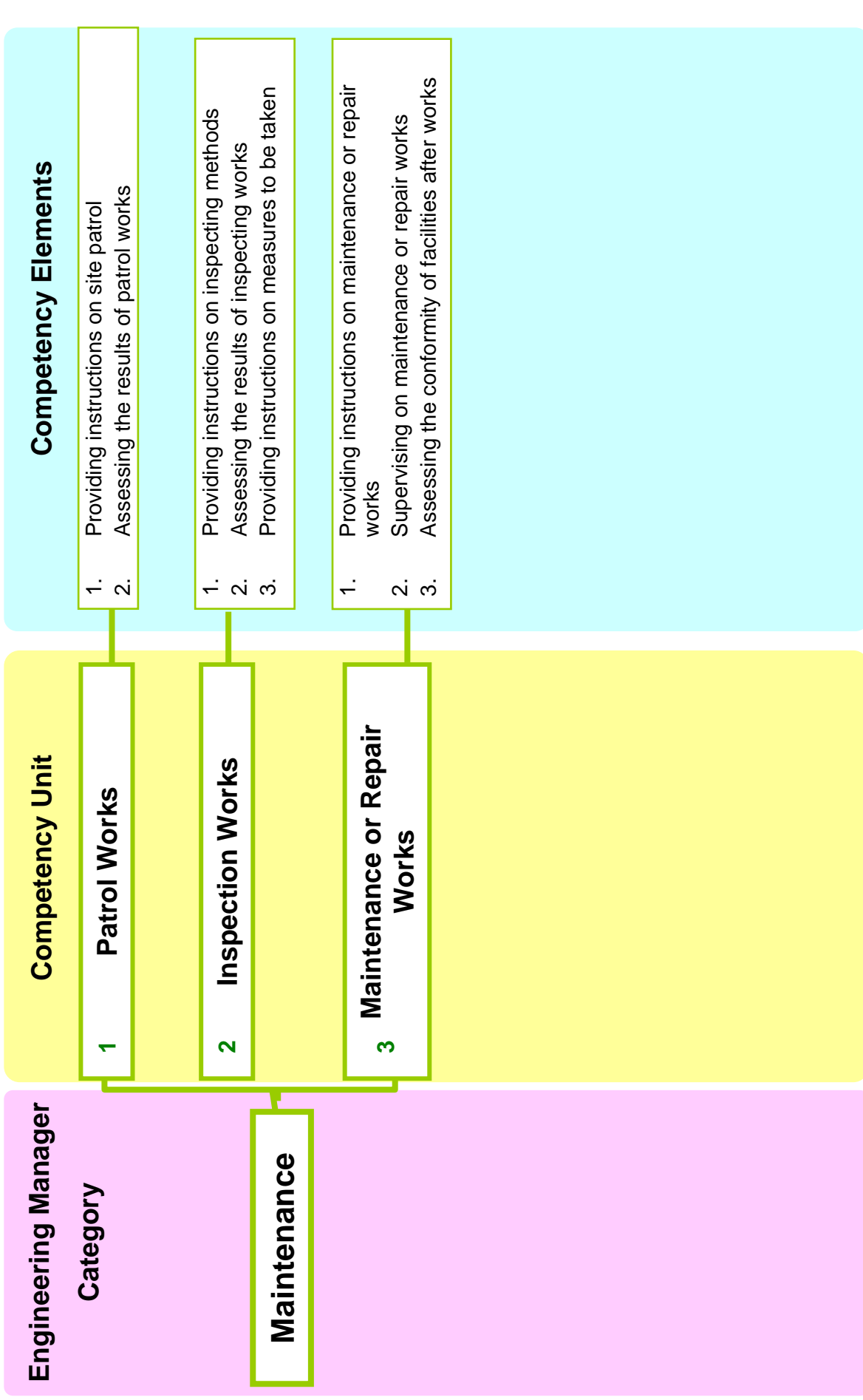
# Thermal Power Generation (Maintenance)



# Transmission & Substation (Maintenance)



# Distribution (Maintenance)



**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Periodical Maintenance Planning for Hydropower (Civil) Plant

Description: This competency unit is related to overall knowledge and supervision of planning on periodical maintenance of hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Knowledge of overall periodical maintenance	1.1. Understanding of category, contents, purpose of periodical maintenance, 1.2. Understanding of standard frequency and items of periodical maintenance for each equipment 1.3. Knowledge of National Safety Requirements and related regulations for periodical maintenance 1.4. Knowledge of Safety Rules and in-house manual for periodical maintenance 1.5. Confirming of implementation of periodical maintenance based on scheduled frequency and items
2. Supervision of periodical maintenance planning	2.1. Assessment of annual periodical maintenance plan 2.2. Understanding of period of periodical maintenance, total expenditure and configuration of facilities 2.3. Assessment of particular items and/or intervals of periodical maintenance decided with the maintenance and/or defect records or use environment of the equipment 2.4. Confirming of implementation of appropriate supplementary measure against excess of regular intervals for maintenance 2.5. Assessment of improvement in items and/or intervals of periodical maintenance based on the maintenance and/or defect records 2.6. Supervising on revision of Safety Rules at improvement in items and/or intervals of periodical maintenance 2.7. Supervising on revision of periodical maintenance plan by order of the regulatory authorities 2.8. Providing instruction on coordination for maintenance works which will impact on operation of power plant 2.9. Providing instruction on method and route of material transportation from technical and safety point of view



**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx  
 Unit Name: Management of Repair Works Planning for Hydropower (Civil) Plant  
 Description: This competency unit is related to overall knowledge and supervision of planning on repair works of hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Knowledge of overall repair works	1.1. Understanding of contents and purpose of repair works 1.2. Knowledge of facilities function and material characteristic 1.3. Understanding of current facility's condition and design value in order to assess the degradation 1.4. Knowledge of National Safety Requirements and related regulations for repair works 1.5. Knowledge of Safety Rules and in-house manual for repair works
2. Supervision of repair works planning	2.1. Understanding of period of repair works and total expenditure etc. 2.2. Assessment of repair methods against the defect 2.3. Assessment of contents of repair work based on the defect record 2.4. Providing instruction on coordination for repair works which will impact on operation of power plant 2.5. Providing instruction on method and route of material transportation from technical and safety point of view 2.6. Judgment of introduction of repair works which adopted new technology 2.7. Assessment of conformity of modification of dam, waterways and gate to national safety requirements and related regulations

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Contractor and Procurement for Periodical Maintenance and Repair Works of Hydropower (Civil) Plant

Description: This competency unit is related to the evaluation of necessary contractor's capability and necessary procurement for hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Evaluation of necessary capability of contractor	1.1. Knowledge of major contractor in electrical power sector 1.2. Understanding of experience and capability of contractor in electrical power sector 1.3. Providing instruction on selection of contractor
2. Evaluation of necessary procurement	2.1. Knowledge of major manufacturer in electrical power sector 2.2. Understanding of manufacturer's experience and application record of materials 2.3. Providing instruction on selection of manufacturer and materials

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Periodical Maintenance and Repair Works for Hydropower (Civil) Plant

Description: This competency unit is related to the supervision on periodical maintenance and repair works including necessary period, overall scheduling of tasks and safety management for hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Supervision of necessary period and overall scheduling of tasks	1.1 Understanding of necessary period of periodical maintenance and repair works 1.2 Understanding of planning of outage with power interruption 1.3 Supervising on progress of periodical maintenance and repair works 1.4 Knowledge of relevant divisions and organizations 1.5 Providing instruction on adjusting the deviation of the actual status from the original plan.
2. Supervision of periodical maintenance and repair works	2.1. Knowledge of methods of periodical maintenance and repair works 2.2. Knowledge of National Safety Requirements 2.3. Knowledge of relevant manufacturer and contractor 2.4. Providing instruction on prior consultation for work procedure 2.5. Assessment of implementation condition of periodical maintenance and repair works based on National Safety Requirements
3. Supervision on safety management	3.1. Understanding of relevant safety guidelines and manuals 3.2. Knowledge of safety monitoring points 3.3. Providing instruction on safety management to subordinate and contractor

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Evaluation and Records of Periodical Maintenance and Repair Works for Hydropower (Civil) Plant

Description: This competency unit is related to the supervision on field inspection, evaluation of commissioning results and record management for hydropower (Civil) plant.

Competency Elements	Performance Criteria
1. Supervising field inspection	1.1 Understanding of numerical criteria provided by safety regulations and requirements 1.2 Understanding of statutory inspection and inspection items after periodical maintenance and repair works 1.3 Understanding of inspection methods and procedures 1.4 Arrangement with supervisory authority 1.5 Providing instruction on corrective action in case of unsuitable result
2. Evaluation of commissioning results	2.1. Understanding of National Safety Requirements, design value and basis 2.2. Assessment of conformity of inspection condition and results to national safety requirement and design value 2.3. Providing instruction on corrective action in case of unsuitable result
3. Supervision of record management	3.1. Understanding of necessary records of periodical maintenance and repair works and period of keeping documents 3.2. Understanding of regulations and decree about records and storage 3.3. Management of records of periodical maintenance and repair works and proper storage

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Maintenance**

Distribution  
(Maintenance1)  
Patrol Works

Unit Cord: xxxxxxxxxxxx

Unit Name: Patrol Works for Distribution Facilities

Description: This competency unit is related to the supervising capability of patrolling works.

<b>Competency Elements</b>	<b>Work Capabilities</b>
1. Providing instruction on site patrol	1.1 Understanding the patrolling works of distribution facilities 1.2 Providing instructions on planning the appropriate patrolling schedule 1.3 Providing instructions on assessment of patrolling results
2. Assessing the results of patrol works	2.1 Understanding records of patrolling works regarding the distribution facilities 2.2 Providing instructions on activities based on the patrol results 2.3 Assessing the conformity to relevant standards / regulations 2.4 Recognizing the weak points of distribution facilities obtained from patrolling works

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Maintenance**

Distribution  
(Maintenance2)  
Inspection Works

Unit Cord: xxxxxxxxxxxx

Unit Name: Inspection Works for Distribution Facilities

Description: This competency unit is related to the supervising capability of patrolling works.

Competency Elements	Work Capabilities
1. Providing instructions on inspecting methods	1.1 Understanding the inspecting works of distribution facilities 1.2 Providing instructions on planning the appropriate inspecting schedule 1.3 Providing instructions on assessment of inspecting results
2. Assessing the results of inspecting works	2.1 Understanding records of inspecting works regarding the distribution facilities 2.2 Evaluating the inspecting results and understanding the condition of the facilities 2.3 Assessing the conformity to relevant standards / regulations 2.4 Recognizing the weak points of distribution facilities obtained from inspection results
3. Providing instructions and measures	3.1 Understanding the measures based on the inspecting results 3.2 Providing instructions on measures based on the inspecting results 3.3 Assessing the results of measures for inspection

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Maintenance**

Distribution  
(Maintenance3)  
Maintenance and  
Repair Works

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Maintenance and Repair Works for Distribution Facilities

Description: This competency unit is related to the supervising capability of maintenance and repair works.

Competency Elements	Work Capabilities
1. Providing instructions on maintenance and repair works	1.1 Understanding the maintenance and repair works for distribution facilities 1.2 Understanding the procedures of maintenance and repair works 1.3 Providing instructions on methods of works for maintenance and repairs 1.4 Assessing the conformity to the relevant standards / regulations
2. Supervising on maintenance and repair works	2.1 Understanding the each step of maintenance and repair works 2.2 Supervising on the maintenance and repair works 2.3 Providing necessary instructions on each step of works 2.4 providing instructions on safety control during maintenance and repair works
3. Assessing the conformity of facilities at the end of works	3.1 Assessing the conformity to the relevant standards/regulations after maintenance and repair works 3.2 Providing instructions and orders in case of power failure

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Periodical Maintenance Planning for Hydropower (mech. & elec.) Plant

Description: This competency unit is related to overall knowledge and supervision of planning on periodical maintenance of hydropower (mech. & elec.) plant.

Competency Elements	Performance Criteria
1. Knowledge of overall periodical maintenance	1.1. Understanding of category, contents, purpose of periodical maintenance, 1.2. Understanding of standard frequency and items of periodical maintenance for each equipment 1.3. Knowledge of National Safety Requirements and related regulations for periodical maintenance 1.4. Knowledge of Safety Rules and in-house manual for periodical maintenance 1.5. Confirming of implementation of periodical maintenance based on scheduled frequency and items
2. Supervision of periodical maintenance planning	2.1. Assessment of annual periodical maintenance plan 2.2. Understanding of period of periodical maintenance, total expenditure and configuration of facilities 2.3. Assessment of particular items and/or intervals of periodical maintenance decided with the maintenance and/or defect records or use environment of the equipment 2.4. Confirming of implementation of appropriate supplementary measure against excess of regular intervals for maintenance 2.5. Assessment of improvement in items and/or intervals of periodical maintenance based on the maintenance and/or defect records 2.6. Supervising on revision of Safety Rules at improvement in items and/or intervals of periodical maintenance 2.7. Supervising on revision of periodical maintenance plan by order of the regulatory authorities 2.8. Providing instruction on coordination for maintenance works which will impact on operation of power plant 2.9. Providing instruction on method and route of material transportation from technical and safety point of view



**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Maintenance**

Unit Code: xxxxxxxxxxxx  
 Unit Name: Management of Repair Works Planning for Hydropower (mech. & elec.) Plant  
 Description: This competency unit is related to overall knowledge and supervision of planning on repair works of hydropower (mech. & elec.) plant.

Competency Elements	Performance Criteria
1. Knowledge of overall repair works	1.1. Understanding of contents and purpose of repair works 1.2. Knowledge of facilities function and material characteristic 1.3. Understanding of current facility's condition and design value in order to assess the degradation 1.4. Knowledge of National Safety Requirements and related regulations for repair works 1.5. Knowledge of Safety Rules and in-house manual for repair works
2. Supervision of repair works planning	2.1. Understanding of period of repair works and total expenditure etc. 2.2. Assessment of repair methods against the defect 2.3. Assessment of contents of repair work based on the defect record 2.4. Providing instruction on coordination for repair works which will impact on operation of power plant 2.5. Providing instruction on method and route of material transportation from technical and safety point of view 2.6. Judgment of introduction of repair works which adopted new technology 2.7. Assessment of conformity of safety interlock modification to National Safety Requirements and related regulation

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxx

Unit Name: Management of Contractor and Procurement for Periodical Maintenance and Repair Works of Hydropower (mech. & elec.) Plant

Description: This competency unit is related to the evaluation of necessary contractor's capability and necessary procurement for hydropower (mech. & elec.) plant.

Competency Elements	Performance Criteria
1. Evaluation of necessary capability of contractor	1.1. Knowledge of major contractor in electrical power sector 1.2. Understanding of experience and capability of contractor in electrical power sector 1.3. Providing instruction on selection of contractor
2. Evaluation of necessary procurement	2.1. Knowledge of major manufacturer in electrical power sector 2.2. Understanding of manufacturer's experience and application record of materials 2.3. Providing instruction on selection of manufacturer and materials

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Maintenance**

Unit Code: xxxxxxxxxxxxxx

Unit Name: Management of Periodical Maintenance and Repair Works for Hydropower (mech. & elec.) Plant

Description: This competency unit is related to the supervision on periodical maintenance and repair works including necessary period, overall scheduling of tasks and safety management for hydropower (mech. & elec.) plant.

Competency Elements	Performance Criteria
1. Supervision of necessary period and overall scheduling of tasks	1.1 Understanding of necessary period of periodical maintenance and repair works 1.2 Understanding of planning of outage with power interruption 1.3 Supervising on progress of periodical maintenance and repair works 1.4 Knowledge of relevant divisions and organizations 1.5 Providing instruction on adjusting the deviation of the actual status from the original plan.
2. Supervision of periodical maintenance and repair works	2.1. Knowledge of methods of periodical maintenance and repair works 2.2. Knowledge of National Safety Requirements 2.3. Knowledge of relevant manufacturer and contractor 2.4. Providing instruction on prior consultation for work procedure 2.5. Assessment of implementation condition of periodical maintenance and repair works based on National Safety Requirements
3. Supervision on safety management	3.1. Understanding of relevant safety guidelines and manuals 3.2. Knowledge of safety monitoring points 3.3. Providing instruction on safety management to subordinate and contractor

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Evaluation and Records of Periodical Maintenance and Repair Works for Hydropower (mech. & elec.) Plant

Description: This competency unit is related to the supervision on field inspection, evaluation of commissioning results and record management for hydropower (mech. and elec.) plant.

Competency Elements	Performance Criteria
1. Supervising field inspection	1.1 Understanding of numerical criteria provided by safety regulations and requirements 1.2 Understanding of statutory inspection and inspection items after periodical maintenance and repair works 1.3 Understanding of inspection methods and procedures 1.4 Arrangement with supervisory authority 1.5 Providing instruction on corrective action in case of unsuitable result
2. Evaluation of commissioning results	2.1. Understanding of National Safety Requirements, design value and basis 2.2. Assessment of conformity of inspection condition and results to national safety requirement and design value 2.3. Providing instruction on corrective action in case of unsuitable result
3. Supervision of record management	3.1. Understanding of necessary records of periodical maintenance and repair works and period of keeping documents 3.2. Understanding of regulations and decree about records and storage 3.3. Management of records of periodical maintenance and repair works and proper storage

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Maintenance**

T&S  
(Maintenance1)  
Patrol Planning

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Patrol & Patrol Planning

Description: This competency unit is related to the supervising capability of maintenance works including patrol & patrol planning of T&S facilities.

Competency Elements	Performance Criteria
1. Providing instruction on site patrol	1.1 Supervision on determining points of site patrol and on preparing necessary instruments and equipment for site patrol.
	1.2 Providing instruction on identifying the fault location
	1.3 Supervision on the investigation of abnormalities near the live lines and tree contact
2. Supervision on public announcement for preventing from accidents	2.1 Providing activities from environmental issues and troubles based on relevant environmental laws and regulations
	2.2 Negotiating with landowners in order to solve problems of environmental matter
	2.3 Supervision on public announcement for preventing from accidents on the public related to transmission line
	2.4 Proposing public announcement for preventing from accidents on the public
3. Providing activities on developing patrol plan	2.1 Supervision on planning special site patrol in appropriate timing
	2.2 Providing instruction on planning site patrol and keeping records of the results properly
	2.2 Judging the introduction of preventive maintenance method

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Maintenance**

T&S
Maintenance2
Field Inspection

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Field Inspection Works and Inspection Planning

Description: This competency unit is related to the supervising capability of maintenance works including field inspection and inspection planning of T&S facilities.

Competency Elements	Performance Criteria
1. Assessing the conformity of inspection results to safety requirements	1.1 Understanding necessary instruments and equipments to be prepared for inspection
	1.2 Identifying necessary process of inspection for each type of facilities
	1.3 Understanding the target criteria of inspection results to judge the acceptance of facilities
2. Providing instruction on inspection planning by assessing its conformity to relevant regulations	2.1 Supervision on preparing working records of high-level regular inspection and evaluation of inspection results
	2.2 Supervision of the management of old facilities to detect the potential of abnormalities and to judge taking preventive measures
	2.3 Supervision on planning regular inspection planning and keep its records properly
	2.4 Providing instruction and advices on inspection planning from the aspect of safety management and keeping records of the results properly

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Maintenance**

<p><b>T&amp;S</b></p> <p>Maintenance3</p> <p>Planning of Repairing Maintenance Works</p>
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Unit Cord: xxxxxxxxxxxx

Unit Name: Planning of Repairing and Maintenance Works.

Description: This competency unit is related to the supervising capability of planning and arrangement of repairing and maintenance works.

Competency Elements	Performance Criteria
1. Supervision of repairing and maintenance works planning	1.1 Supervision on managing old facilities to plan repairing works and to apply preventive measures
	1.2 Understanding constriction scale such as period of construction works and total expenditure
	1.3 Judging the introduction of trend management and analysis
	1.4 Supervision on planning of repairing and maintenance works in power interruption in coordination with other relevant divisions and organizations
2. Supervision of investigation and designing for repairing and maintenance works	2.1 Understanding equipments such as transformer and circuit breaker and every variety work methods
	2.2 Coordination with relevant divisions and organizations and providing instruction for subordinate
3. Providing instruction on the procedures of subcontracting and procurement works	3.1 Understanding necessary period of material procurement
	3.2 Coordination with relevant manufacturer and construction company
	3.3 Judging the introduction of new work methods

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Maintenance**

<p><b>T&amp;S</b>  (Maintenance4)  Management of  Repairing Works</p>
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Unit Cord: xxxxxxxxxxxx

Unit Name: Management of Repairing and Maintenance Works

Description: This competency unit is related to the supervising capability of safety, construction and process management of repairing and maintenance works.

Competency Elements	Performance Criteria
1. Supervision of safety management of repairing and maintenance works	1.1 Providing instruction on determining the area of power interruption taking measures for maintaining necessary clearance from hot wire
	1.2 Providing instruction necessary measures for high place works
	1.3 Providing instruction necessary measures for underground works
	1.4 Providing instruction necessary measures to maintain clearance in conducting works close to the public
2. Supervision of construction management of repairing and maintenance works	2.1 Providing supervision on protection treatment on underground facilities and earthing lines
	2.2 Providing supervise on the operation of construction machines
	2.2 Providing instruction on the judgment criteria for safety management
3. Supervision of process management of repairing and maintenance works	3.1 Supervision of determining necessary period of repairing and maintenance works and overall scheduling of tasks
	3.2 Supervision on repairing and maintenance works and providing instruction in case of big changeover from the original plan



**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Maintenance**

T&S  
(Maintenance5)  
Evaluation of  
Repairing Works

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Evaluation of Repairing and Maintenance Works

Description: This competency unit is related to the supervising capability of evaluation of repairing and maintenance works including assessment and acceptance tests.

Competency Elements	Performance Criteria
1. Providing instruction on the items to be confirmed before and after initial charging and assessing the results	1.1 Understanding zone for trial line charging and indicators for evaluating of results
	1.2 Proposing announcement of zone for trial line charging
	1.3 Providing instruction of trial charging such as connecting and disconnecting
	1.4 Providing instruction to operators
2. Supervision on evaluating the commissioning test after completion of repairing and maintenance works	2.1 Understanding national safety requirements
	2.2 Assessing the conformity of inspection results
	2.3 Judging the introduction of new technology equipments
	2.4 Provide proper instruction for solving problem, if it is not suitable results
2. Supervision on preparing working records of repairing and maintenance works	2.1 Understanding indicators for evaluating of results
	2.2 Understanding necessary item for reporting
	2.3 Judging the introduction of necessary document management system

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Maintenance**

<p>T&amp;S  Maintenance6  Inspection of  protection relays</p>
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Inspection of protection relays

Description: This competency unit is related to the supervising capability of inspection of protection relays.

Competency Elements	Performance Criteria
1. Judging the acceptance of inspection results	1.1 Understanding the specifications and functions of protection relays
	1.2 Understanding indicators for evaluating of results
	1.3 Evaluation of inspection results
	1.4 Provide proper instruction for solving problem, if it is not suitable results
2. Providing supervision on regular inspection	2.1 Identifying necessary process of inspection for each type of protection relays
	2.2 Providing instruction for subordinate
	2.3 Understanding indicators for evaluating of results and evaluation of inspection results
	2.4 Judging the introduction of necessary document management system
3. Supervision on the management of maintenance schedule	3.1 Understanding relevant safety regulations, rule and standards
	3.2 Identifying necessary process of inspection for each type of facilities
	3.3 Coordination with relevant divisions and organizations and providing instruction for subordinate
	3.4 Judging the introduction of trend management and analysis for protection relays and auxiliary

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Maintenance**

<p>T&amp;S (Maintenance7) Patrol of protection relays</p>
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Patrol of protection relays

Description: This competency unit is related to the supervising capability of patrol of protection relays.

Competency Elements	Performance Criteria
1. Providing instruction on site patrol of protection relays	1.1 Understanding the specifications and functions of protection relays and identifying necessary process of patrol
	1.2 Supervision on determining points of site patrol and on preparing necessary instruments and equipment for site patrol.
	1.3 Judging the abnormality in vibration and overheat of analog relays taking into account their characteristic
	1.4 Judging the introduction of preventive maintenance method
2. Supervision on preparing necessary measures against troubles with protection relays	2.1 Understanding the methodology of protection co-ordination
	2.2 Coordination with relevant divisions and organizations and providing instruction for subordinate about switching network configuration
	2.3 Provide proper instruction for temporary counter-measure against accidents such as switching network configuration
3. Supervision on the management of site patrol schedule	3.1 Understanding relevant safety regulations, rule and standards
	3.2 Supervision on planning irregular site patrol in appropriate timing
	3.3 Coordination with relevant divisions and organizations and providing instruction for subordinate

**Power Engineers Competency Standard**  
**Basic Group: Thermal Power Generation**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of periodical maintenance planning for Thermal power plant

Description: This competency unit is related to overall knowledge and supervision of planning on periodical maintenance of thermal power plant.

Competency Elements	Performance Criteria
1. Knowledge of overall periodical maintenance	1.1. Understanding of category, contents, purpose of periodical maintenance, 1.2. Understanding of standard frequency and items of periodical maintenance for each equipment 1.3. Knowledge of National Safety Requirements and related regulations for periodical maintenance 1.4. Knowledge of Safety Rules and in-house manual for periodical maintenance 1.5. Confirming of implementation of periodical maintenance based on scheduled frequency and items
2. Supervision of periodical maintenance planning	2.1. Assessment of annual periodical maintenance plan 2.2. Understanding of period of periodical maintenance, total expenditure and configuration of facilities 2.3. Assessment of particular items and/or intervals of periodical maintenance decided with the maintenance and/or defect records or use environment of the equipment 2.4. Confirming of implementation of appropriate supplementary measure against excess of regular intervals for maintenance 2.5. Assessment of improvement in items and/or intervals of periodical maintenance based on the maintenance and/or defect records 2.6. Supervising on revision of Safety Rules at improvement in items and/or intervals of periodical maintenance 2.7. Supervising on revision of periodical maintenance plan by order of the regulatory authorities 2.8. Providing instruction on coordination for maintenance works which will impact on operation of power plant 2.9. Providing instruction on method and route of material transportation from technical and safety point of view

**Power Engineers Competency Standard**  
**Basic Group: Thermal Power Generation**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx  
 Unit Name: Management of repair works planning for Thermal power plant  
 Description: This competency unit is related to overall knowledge and supervision of planning on repair works of thermal power plant.

Competency Elements	Performance Criteria
1. Knowledge of overall repair works	1.1. Understanding of contents and purpose of repair works 1.2. Knowledge of facilities function and material characteristic 1.3. Understanding of current facility's condition and design value in order to assess the degradation 1.4. Knowledge of National Safety Requirements and related regulations for repair works 1.5. Knowledge of Safety Rules and in-house manual for repair works
2. Supervision of repair works planning	2.1. Understanding of period of repair works and total expenditure etc. 2.2. Assessment of repair methods against the defect 2.3. Assessment of contents of repair work based on the defect record 2.4. Providing instruction on coordination for repair works which will impact on operation of power plant 2.5. Providing instruction on method and route of material transportation from technical and safety point of view 2.6. Judgment of introduction of repair works which adopted new technology 2.7. Assessment of conformity of safety interlock modification to National Safety Requirements and related regulation

**Power Engineers Competency Standard**  
**Basic Group: Thermal Power Generation**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of contractor and procurement for periodical maintenance and repair works of Thermal power plant

Description: This competency unit is related to the evaluation of necessary contractor’s capability and necessary procurement for thermal power plant.

Competency Elements	Performance Criteria
1. Evaluation of necessary capability of contractor	1.1. Knowledge of major contractor in electrical power sector 1.2. Understanding of experience and capability of contractor in electrical power sector 1.3. Providing instruction on selection of contractor
2. Evaluation of necessary procurement	2.1. Knowledge of major manufacturer in electrical power sector 2.2. Understanding of manufacturer's experience and application record of materials 2.3. Providing instruction on selection of manufacturer and materials

**Power Engineers Competency Standard**  
**Basic Group: Thermal Power Generation**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of periodical maintenance and repair works for Thermal power plant

Description: This competency unit is related to the supervision on periodical maintenance and repair works including necessary period, overall scheduling of tasks and safety management for thermal power plant.

Competency Elements	Performance Criteria
1. Supervision of necessary period and overall scheduling of tasks	1.1 Understanding of necessary period of periodical maintenance and repair works 1.2 Understanding of planning of outage with power interruption 1.3 Supervising on progress of periodical maintenance and repair works 1.4 Knowledge of relevant divisions and organizations 1.5 Providing instruction on adjusting the deviation of the actual status from the original plan.
2. Supervision of periodical maintenance and repair works	2.1. Knowledge of methods of periodical maintenance and repair works 2.2. Knowledge of National Safety Requirements 2.3. Knowledge of relevant manufacturer and contractor 2.4. Providing instruction on prior consultation for work procedure 2.5. Assessment of implementation condition of periodical maintenance and repair works based on National Safety Requirements
3. Supervision on safety management	3.1. Understanding of relevant safety guidelines and manuals 3.2. Knowledge of safety monitoring points 3.3. Providing instruction on safety management to subordinate and contractor

**Power Engineers Competency Standard**  
**Basic Group: Thermal Power Generation**  
**Group: Maintenance**

Unit Cord: xxxxxxxxxxxxxx

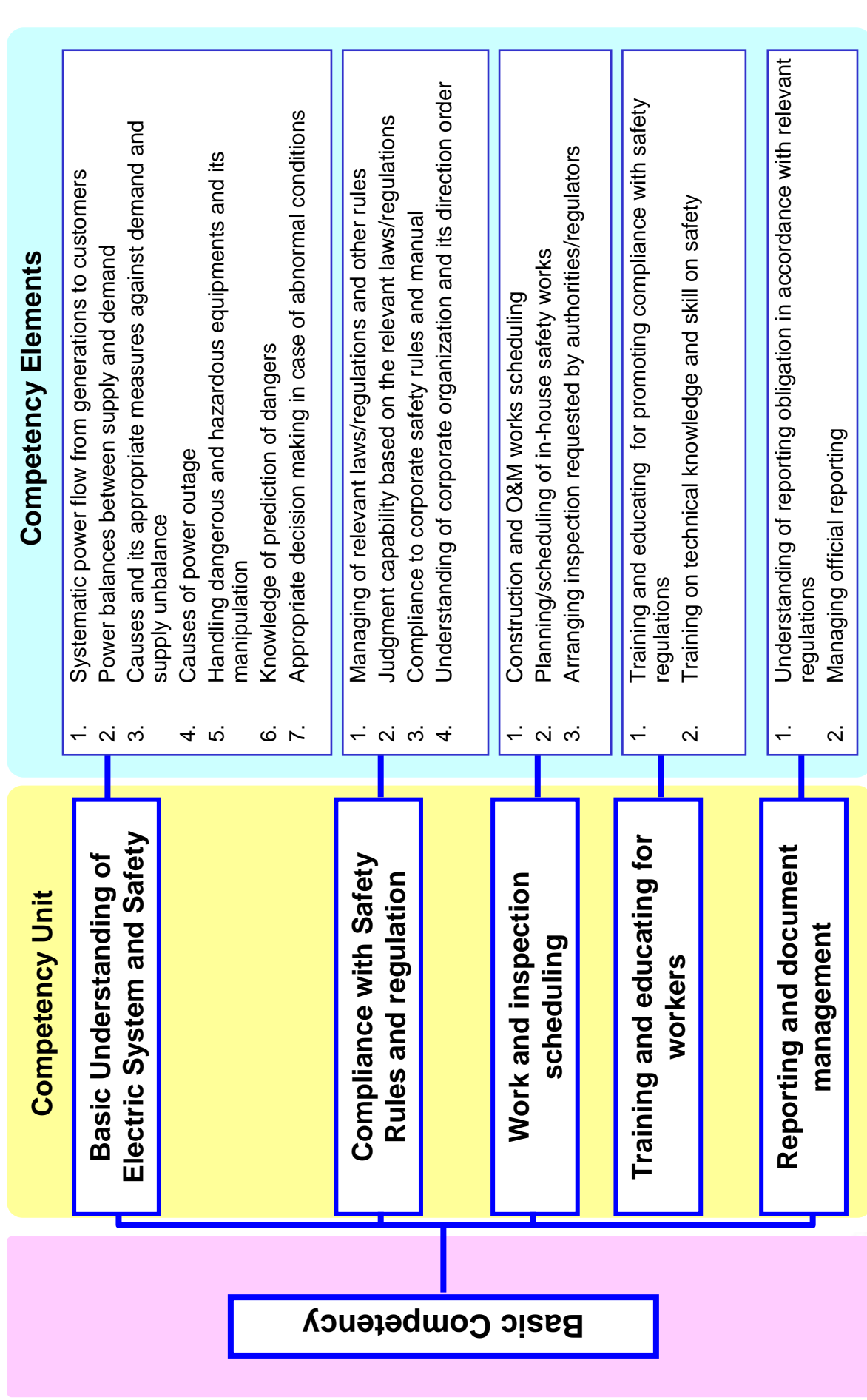
Unit Name: Evaluation and Record of periodical maintenance and repair works for Thermal power plant

Description: This competency unit is related to the supervision on field inspection, evaluation of commissioning results and record management for thermal power plant.

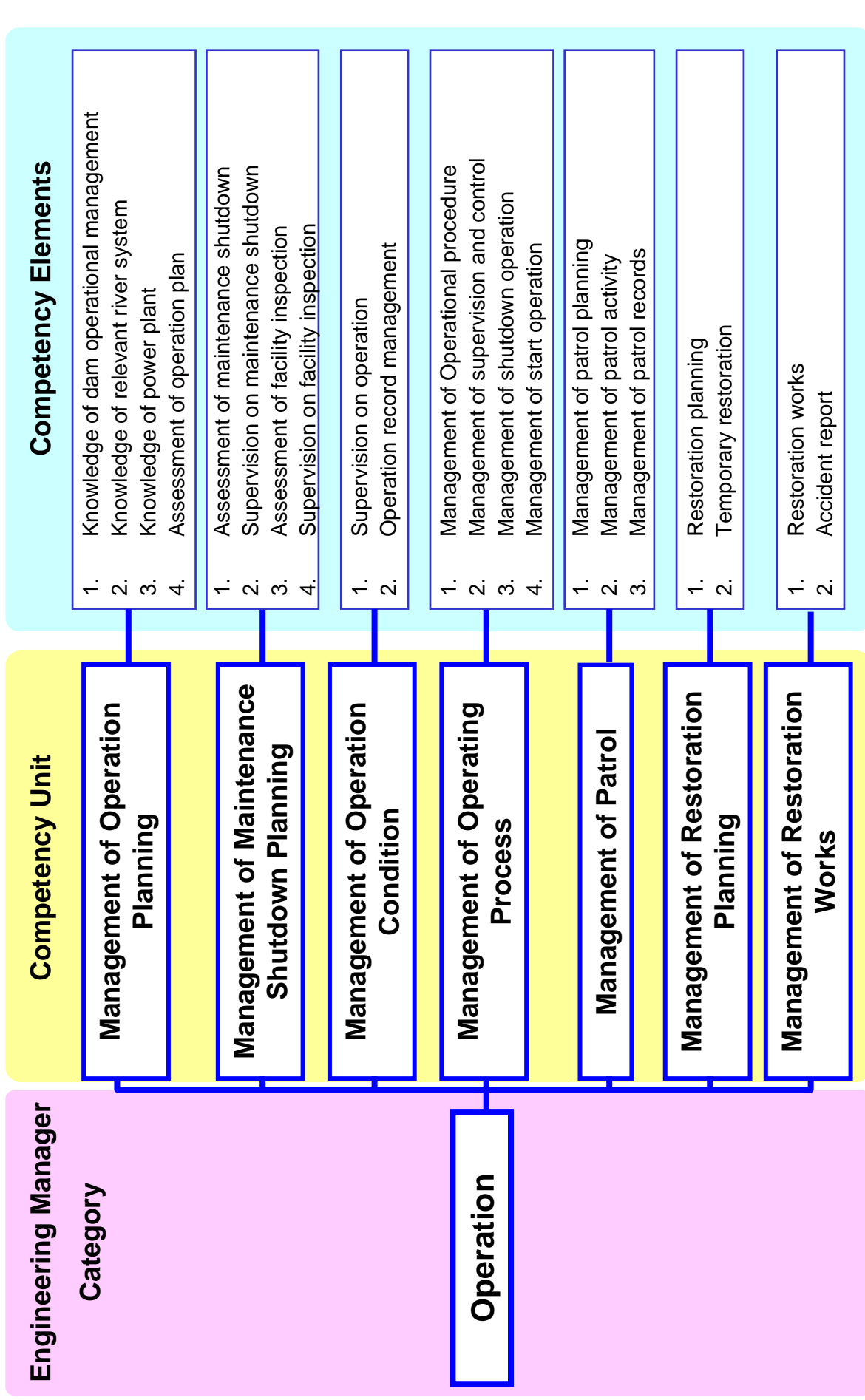
Competency Elements	Performance Criteria
1. Supervising field inspection	1.1 Understanding of numerical criteria provided by safety regulations and requirements 1.2 Understanding of statutory inspection and inspection items after periodical maintenance and repair works 1.3 Understanding of inspection methods and procedures 1.4 Arrangement with supervisory authority 1.5 Providing instruction on corrective action in case of unsuitable result
2. Evaluation of commissioning results	2.1. Understanding of National Safety Requirements, design value and basis 2.2. Assessment of conformity of inspection condition and results to national safety requirement and design value 2.3. Providing instruction on corrective action in case of unsuitable result
3. Supervision of record management	3.1. Understanding of necessary records of periodical maintenance and repair works and period of keeping documents 3.2. Understanding of regulations and decree about records and storage 3.3. Management of records of periodical maintenance and repair works and proper storage



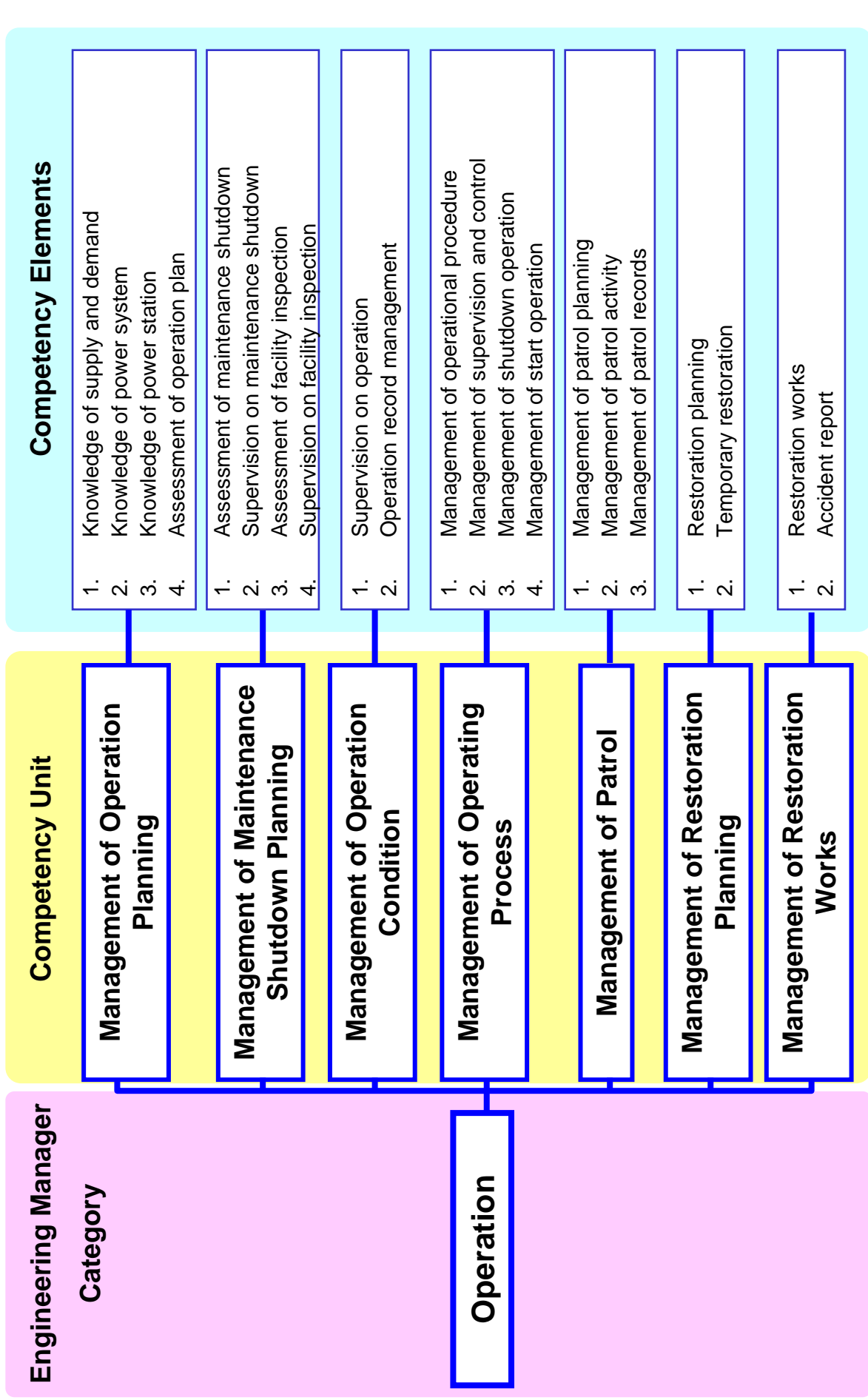
# Basic Competency



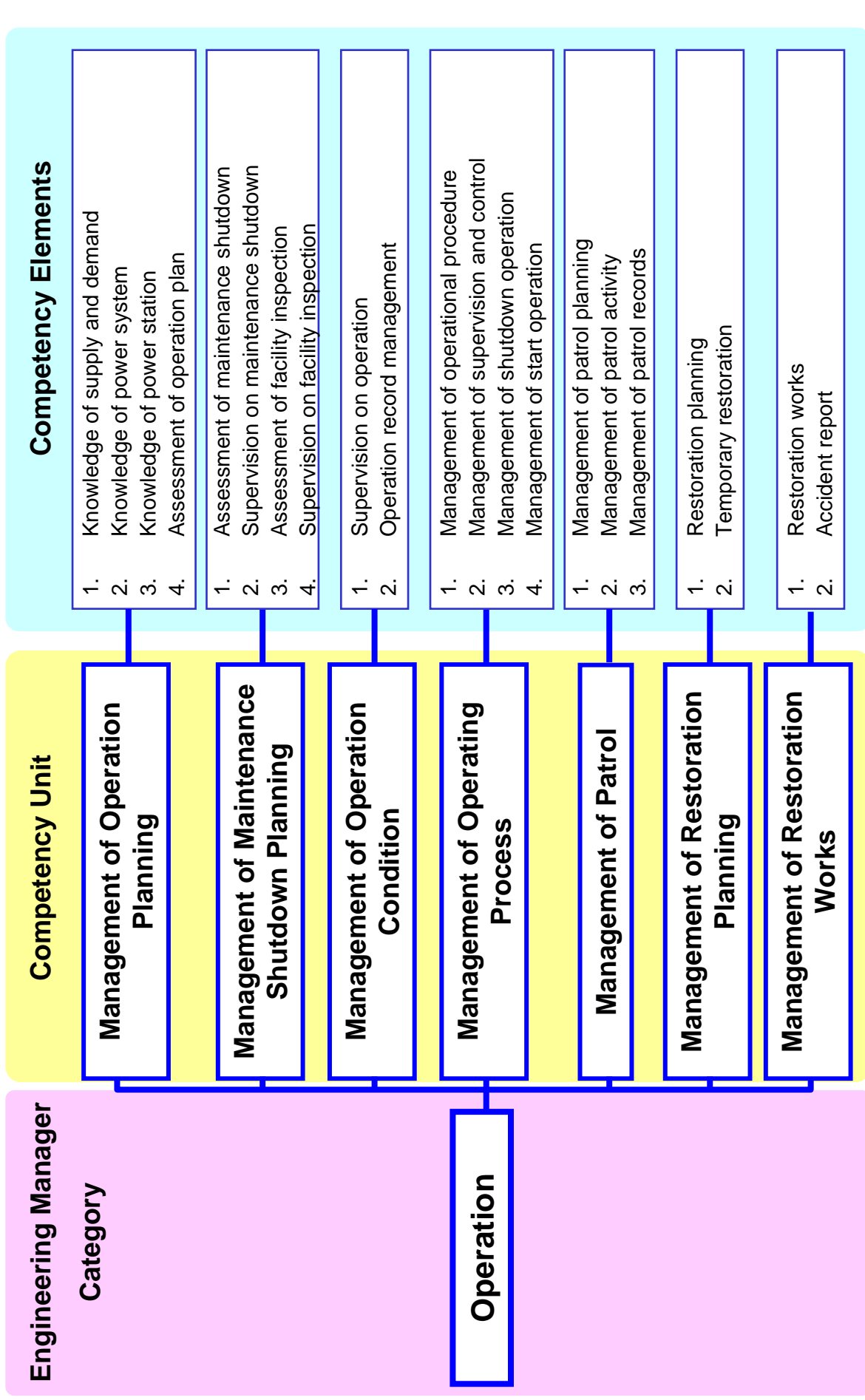
# Hydropower Generation <Civil> (Civil)



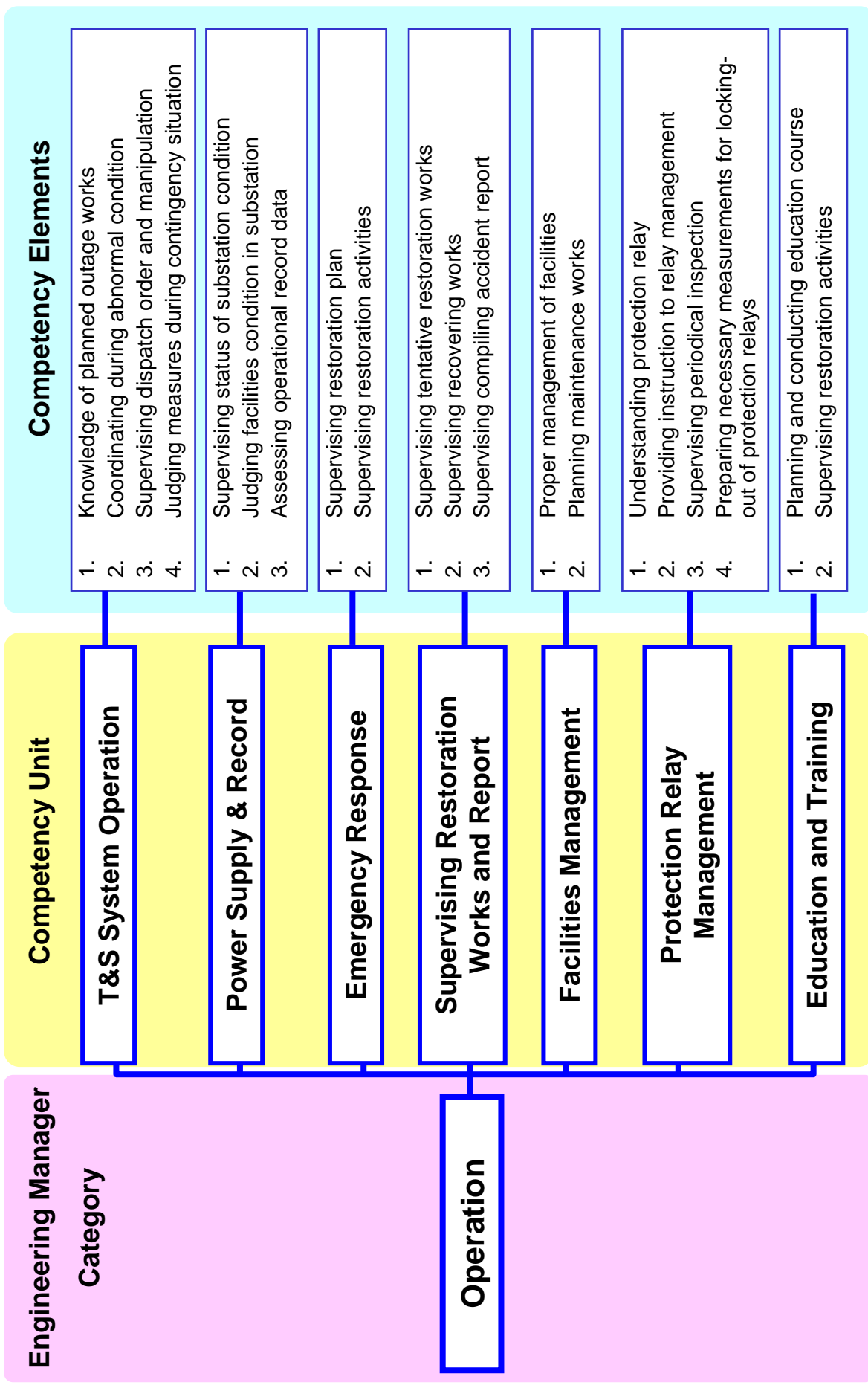
# Hydropower Generation <Mechanical & Electrical> (Operation)



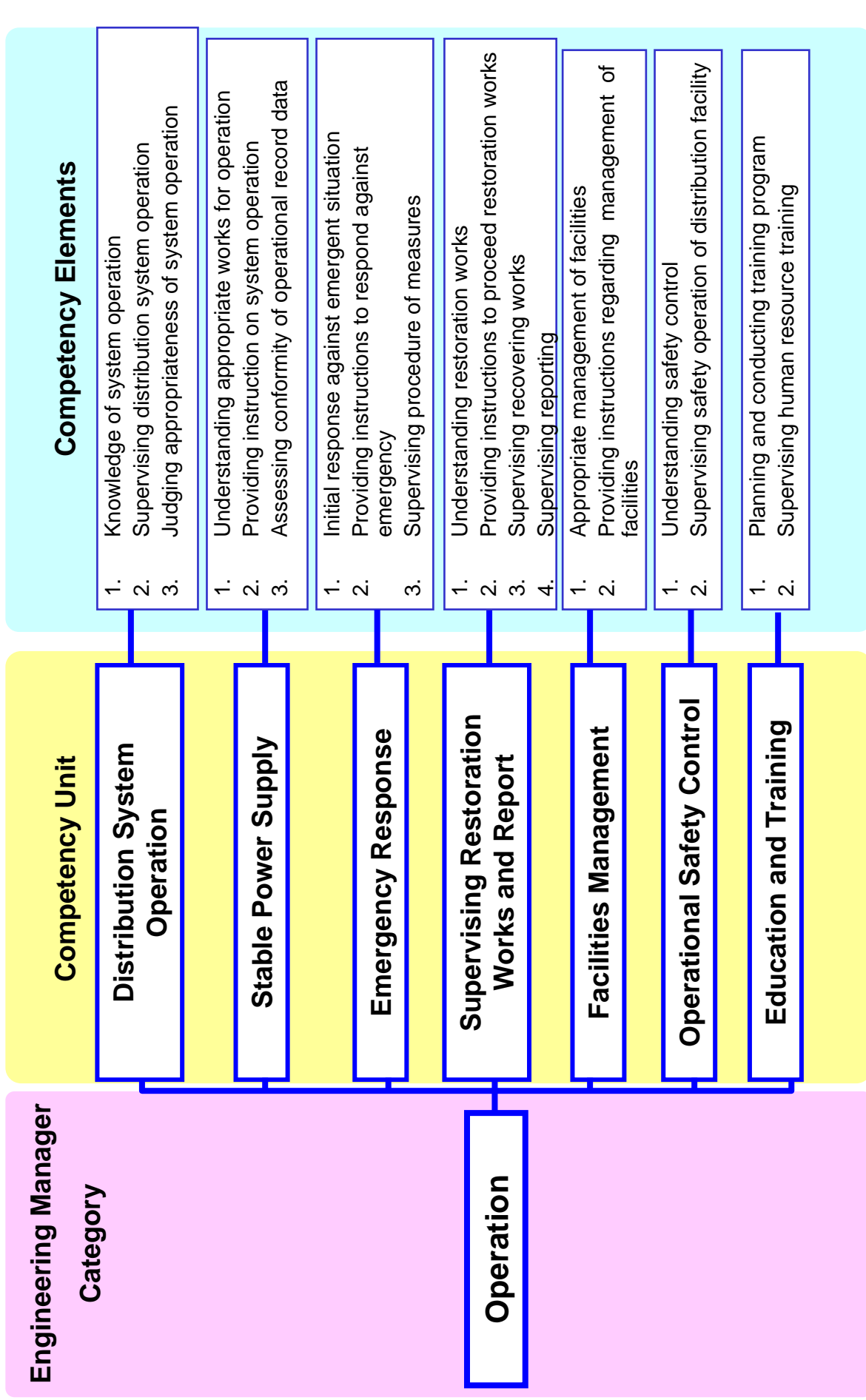
# Thermal Power Generation (Operation)



# Transmission & Substation (Operation)



# Distribution (Operation)



**Power Engineers Competency Standard**

**Basic Group: Basic Competency**

**Group: Basic Competency**

Basic Competency 1  
Basic Knowledge  
Electric Power &  
Safety

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Basic Understanding of Electric Power System and Safety

Description: This competency unit is related to basic understanding of electric power system and safety

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Understanding the knowledge of systematic power flow from generations to customers	1.1 Understanding type, function and supply of generating fuel 1.2 Understanding transmission system voltage 1.3 Understanding distribution system voltage 1.4 understanding function of meter and service wire
2. Understanding the power balances between supply and demand.	Version 1: 2.1 Understanding load control of interconnection of transmission system 2.2 Understanding load control of interconnection of distribution system
	Version 2: 2.1. Understanding system balance between supply and demand 2.2. Understanding availabilities of supply for peak demand
3. Understanding the causes and its appropriate measures against demand and supply unbalance	3.1 Understanding the relationship of supply capacity and peak demand 3.2 Understanding peak load increase and generating capacity 3.3 Understanding maintenance schedule of each facilities Understanding real time operation of each facilities
4. Understanding the causes of power outage	4.1 Understanding the power supply during abnormal condition 4.2 Understanding the phenomena and causes of outage 4.3 Understanding power shortage because of generating collapse

<p>5. Understanding the knowledge of handling dangerous and hazardous equipments and its manipulation</p>	<p>5.1 Understanding the basic knowledge of characteristic of electricity</p> <p>5.2 Understanding the systematic knowledge of electric shock and dangerous factors</p> <p>5.2 Understanding the prevention methods against electric Resistance, flammable items, explosion and electric induction etc.</p>
<p>6. Understanding the knowledge of prediction of dangers</p>	<p>6.1 Understanding how to stop workers and public accidents caused by electric power facilities</p> <p>6.2 Understanding to predict dangers during electric works</p> <p>6.3 Understanding the function of failsafe system</p>
<p>7. Appropriate decision making in case of abnormal condition</p>	<p>7.1 Understanding appropriate measurement in case of abnormal condition such as electric failures, fire, electric shock and other accident</p> <p>7.2 Understanding the measurements to prevent from accident expansion and chain reaction</p>



**Power Engineers Competency Standard**

**Basic Group: Basic Competency**

**Group: Basic Competency**

Basic Competency 2  
Compliance with  
Safety Rules

Unit Cord: xxxxxxxxxxxx

Unit Name: Compliance with Safety Rules and regulation

Description: Comprehensive knowledge of safety regulations on electric power facilities, ability to manage compliance to corporate safety rules and manuals on safety.

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Understanding and managing of relevant laws/regulations and other rules	1.1 Understanding the knowledge electric safety rules and managing it 1.2 Understanding the knowledge of relevant rules and regulation except electric facilities, such as fire protection, labor safety and other accidents
2. Judgment capability based on the relevant laws/regulations	2.1 Making judgment in conformity to relevant regulation on planning and design of construction, operation and maintenance of the electric facilities 2.2 Making judgment in conformity to relevant regulation on labors work condition and any other phenomena in electric fields
3. Compliance to corporate safety rules and manuals	3.1 Making judgment in conformity to corporate safety rule and manual on construction, operation and maintenance 3.2 Understanding penalty terms and impacts in case of the deviation of the regulation
4. Understanding of corporate organization and its direction order	4.1 Assessing the existing corporate organization from the point of facility safety operation 4.2 Giving suggestion and monitoring organization reform 4.3 Giving suggestion and monitoring the structure of direction order (dispatching)

**Power Engineers Competency Standard**  
**Basic Group: Basic Competency**  
**Group: Basic Competency**

Basic Competency 3  
Work Scheduling

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Work and inspection scheduling

Description: Assessing the work plan of construction and O&M, and planning of in-corporate inspection, site investigation.

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Construction and O&M work scheduling	1.1 Assessing the work scheduling of construction and O&M from the point of safety measurement 1.2 Giving suggestion and monitoring its proper scheduling 1.3 Visiting work site and making sure its appropriate work
2. Planning/scheduling of in-house safety works	2.1 Planning and scheduling site inspection to confirm the safety condition of the facilities 2.2 Advising its improvement in case of unsuitable condition,
3. Arranging inspection by authorities/regulators	3.1 When authorities / regulators conduct facilities inspections, arrange and coordinate them.

**Power Engineers Competency Standard**  
**Basic Group: Basic Competency**  
**Group: Basic Competency**

Basic Competency 4  
Training and  
education

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Training and educating for workers

Description: Providing training and education programs regarding safety and facilities proper operation.

Competency Elements	Performance Criteria
1. Training and educating for promoting compliance with safety regulations	1.1 Planning and conducting the education program about safety regulation for the workers 1.2 Enlightenment the safety consciousness to promote safety events 1.3 Conducting safety seminar after accidents to prevent from recurrence
2. Training on technical knowledge and skill on safety	2.1 Planning and conducting the education program about safety operation and manipulation of the facilities 2.2 Supervising and give suggestion to technical training of each facilities

**Pewer Engineers Competency Standard**  
**Basic Group: Basic Competency**  
**Group: Basic Competency**

Basic Competency 5
Reporting and document management

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Reporting and document management

Description: Supervision on the mandatory reporting based on evaluation of reports.

Competency Elements	Performance Criteria
1. Understanding of reporting obligation in accordance with relevant regulations	1.1 Supervising the contents of mandatory report and accidents report to authorities 1.2 Confirming format of document is suitable officially for regulation 1.3 Supervising and making sure the report should be done by the deadline and having responsibilities on the contents
2. Managing official reporting	2.1 Reviewing and evaluating the aforementioned report 2.2 If there are some revisions, he / she should order the alternation 2.3 Supervising proper storage of official documents

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Operation**

Distribution (Operation 1)  System Operation
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Unit Cord: xxxxxxxxxxxx

Unit Name: Supervising the distribution system operation for stable power supply

Description: This competency unit is related to the distribution system operation for stable/reliable power supply based on the respective laws and regulations.

Competency Elements	Performance Criteria
1. Understanding the distribution system operation	1.1 Understanding the basic knowledge of distribution system operation. 1.2 Understanding the stable/reliable power supply 1.3 Understanding the basic knowledge of operational safety
2. Supervising the distribution system operating condition	2.1 Supervising the operating condition of distribution system 2.2 Supervising the supply area (outage or not) of distribution network 2.3 Understanding the weak point of distribution system (overloading, aging etc.)
3. Judging the appropriateness of distribution system operation	3.1 Assessing the distribution system condition (power flow, voltage level, flickers etc.) 3.2 Supervising the safety condition according to the regulation (environmentally, electrically)

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Operation**

Distribution (Operation 2) Power Supply & Record
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Supervising the daily works of distribution operation

Description: This competency unit is related to the actual distribution operating daily works for stable/reliable power supply based on the respective laws and regulations.

Competency Elements	Performance Criteria
1. Understanding the appropriate daily works of distribution operation	1.1 Understanding the roles of daily works of distribution system operation.(Patrol, Investigation)
2. Providing the instruction on distribution system operation	2.1 Supervising the process of daily works regarding the system operation 2.2 Providing the necessary instructions to do appropriate daily works.
3. Assessing the conformity of distribution system operation	3.1 Understanding the SOP of distribution system operation 3.2 Understanding the safety rules of distribution system operation 3.2 Assessing the conformity of distribution system operation 3.4 Assessing the conformity of operation records to laws and regulations and identification of inappropriate cases

**Power Engineers Competency Standard**

**Basic Group: Distribution**

**Group: Operation**

Distribution  
(Operation 3)  
Emergency  
Response

Unit Cord: xxxxxxxxxxxx

Unit Name: Supervising the distribution emergency response

Description: This competency unit is related to the emergency response to maintain stable/reliable power supply based on the respective laws and regulations.

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Understanding of initial response against emergent situation	1.1 Understanding the network situation under trouble 1.2 Grasping the power supply situation (outage area) anytime. 1.3 Understanding the possible measures to secure the safety. 1.4 Understanding the possible measures to do to find a problem
2. Providing instructions to respond against emergency	2.1 Selecting an optimal measures to do 2.2 Providing instructions regarding the measures to do against emergency (including finding a fault point) 2.3 Providing the instructions regarding the safety operation
3. Supervising the procedure of measures	2.1 Supervising the process of responding against emergency 2.2 Supervising the works of safety control

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Operation**

Distribution  
 (Operation 4)  
 Restoration Works

Unit Cord: xxxxxxxxxxxx

Unit Name: Supervising the distribution system restoration works

Description: This competency unit is related to the distribution system restoration and analysis & reporting when the emergency situation.

Competency Elements	Performance Criteria
1. Understanding the restoration works	1.1 Understanding the restoration works (including rules of restoration) 1.2 Understanding the procedures of restoration (step by step) 1.3 Understanding the causes of problem 1.4 Understanding the each situation of restoration
2. Providing instructions to proceed restoration works	2.1 Providing the instructions to do restoration works properly. 2.2 Providing instructions regarding the appropriate method when needed.
3. Supervising the restoration works	3.1 Supervising the entire restoration works 3.2 Supervising the individual restoration works 3.3 Supervising situation of outage restoration 3.4 Supervising the safety of restoration works
4. Reporting of the situations	4.1 Understanding the analysis of trouble causes 4.2 Understanding the measures for preventing recurrence and the expansion of damages 4.3 Supervision on compiling detail report on the accident of distribution facilities 4.4 Reporting to an appropriate authority



**Power Engineers Competency Standard**

**Basic Group: Distribution**

**Group: Operation**

Distribution (Operation 5) Facilities Management
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Unit Cord: xxxxxxxxxxxx

Unit Name: Supervising the facility management

Description: This competency unit is related to the facility management, outage management for an appropriate operational management.

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Understanding the appropriate management of distribution facilities	1.1 Understanding appropriate distribution facilities based on a regulation / safety requirements 1.2 Understanding the facility conditions 1.3 Understanding an appropriate facility operation based on the regulation/requirements 1.3 Understanding the weak points of distribution facilities
2. Providing instructions regarding the management of distribution facilities	2.1 Providing instructions on appropriate management of distribution facilities (data management view points) 2.2 Providing instructions on efficient facility management (optimal operation) 2.3 Providing instructions to conform to the regulation regarding the facility operation

**Power Engineers Competency Standard**  
**Basic Group: Distribution**  
**Group: Operation**

Distribution  
 (Operation 6)  
 Operational Safety  
 Control

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Supervising the operational safety control

Description: This competency unit is related to the safety management of an appropriate operational management.

Competency Elements	Performance Criteria
1. Understanding the safety control of operation	1.1 Understanding the safety requirements on electric power facilities 1.2 Understanding the safety control for distribution facility operation 1.3 Understanding the securing safety of facility operation
2. Supervising the safety operation	2.1 Supervising the safety of workers under operating duty 2.2 Providing instructions to let workers secure the facility safety 2.3 Providing instructions to improve the unsafe situation 2.4 Providing the educational instructions regarding the safety

**Power Engineers Competency Standard**

**Basic Group: Distribution**

**Group: Operation**

Distribution  
(Operation 7)  
Education &  
Training

Unit Cord: xxxxxxxxxxxx

Unit Name: Implementing the educational & technical training

Description: This competency unit is related to the human resource training for safe and reliable operation.

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Planning and conducting training program	1.1 Planning the effective training program on system operation 1.2 Planning the safety education based on safety regulation 1.3 Conducting effective operating training for safety.
2. Supervising the human resource training	1.1 Supervising the training to recognize the technical level 1.2 Assessing the capability of trainee.

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**

**Group: Operation**

Hydro (Civil)  
 (Operation 1)  
 Operation Planning

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Operation planning

Description: This competency unit is related to the operation planning management about dam operational management, relevant river system, power plant and operation plan for hydropower plant.

Competency Elements	Performance Criteria
1. Knowledge of dam operational management	2.1. Knowledge of water level at the dam, intake and outflow discharge in the downstream
	2.2. Knowledge of dam operational management in normal condition
	2.3. Knowledge of countermeasures for flood
2. Knowledge of relevant river system	2.1. Understanding of role of hydropower plant in control of the relevant river system
	2.2. Understanding of characteristic of relevant river system
3. Knowledge of power plant	3.1 Understanding of facility configuration
	3.2 Understanding of characteristic of relevant power plant
	3.3 Understanding of operation permit matter of relevant power plant
4. Assessment of operation plan	4.1 Knowledge of statutory inspection, inspection items and period
	4.2 Understanding of maintenance plan for relevant power station
	4.3 Assessment of long term operation plan
	4.4 Assessment of monthly and yearly operation plan
	4.5 Arrangement with load dispatch division for operation plan

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Operation**

Hydro (Civil)
(Operation 2)
Maintenance
Planning

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of maintenance shutdown planning

Description: This competency unit is related to the maintenance shutdown planning management about assessment and supervision for maintenance shutdown and facility inspection for hydropower plant.

Competency Elements	Performance Criteria
1. Assessment of maintenance shutdown	1.1 Understanding of necessity and contents of maintenance works with shutdown
	1.2 Assessment of necessary outage duration and equipments for maintenance shutdown
2. Supervision on maintenance shutdown	2.1 Knowledge of relevant divisions and organizations to coordinate maintenance shutdown
	2.2 Supervision on shutdown management for maintenance work
3. Assessment of facility inspection	3.1 Understanding of necessity and contents of facility inspection
	3.2 Assessment of necessary inspection duration and equipments
	3.3 Assessment of organization for inspection
4. Supervision on facility inspection	4.1 Knowledge of relevant divisions and organizations to coordinate the inspection
	4.2 Supervision on operation management for inspection

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Operation**

Hydro (Civil)
(Operation 3)
Management
Operating Condition

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of operating condition

Description: This competency unit is related to the operating condition management about supervision and records for hydropower plant.

Competency Elements	Performance Criteria
1. Supervision on operation	1.1 Understanding of facility's operating condition
	1.2 Understanding of target range and environmental restrictions
	1.3 Providing instruction for maintaining proper conditions of facilities
	1.4 Assessment of conformity of relevant regulations
	1.5 Providing instruction of countermeasure against nonconformity
	1.6 Supervision on schedule of facility renovation
	1.7 Assessment of organization for operation
	1.8 Assessment of countermeasure for human error
2. Operation record management	2.1 Understanding of operating record items
	2.2 Management of accountable records
	2.3 Assessment of storage condition of operation records

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**

**Group: Operation**

Hydro (Civil)  
 (Operation 4)  
 Operation Process

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of operating process

Description: This competency unit is related to the operating process management about procedure, supervision, control, startup and shutdown for hydropower plant.

Competency Elements	Performance Criteria
1. Management of Operational procedure	1.1 Knowledge of operating methods
	1.2 Understanding of startup/shutdown operation for power plant
	1.3 Assessment of operational procedures
	1.4 Assessment of organization to confirm operational procedures
2. Management of supervision and control	2.1 Ability of fault detection with meter, indicator and alarm
	2.2 Supervising on operation under dispatching order in line with procedure in manuals
	2.3 Supervising on countermeasures against abnormal in line with procedure in manuals
3. Management of shutdown operation	3.1 Knowledge of relevant divisions and organizations to coordinate shutdown operation
	3.2 Knowledge of items of preliminary confirmation for shutdown operation
	3.3 Knowledge of items of confirmation after shutdown operation
	3.4 Knowledge of intake stop in the powerhouse and dam
4. Management of start operation	4.1 Knowledge of relevant divisions and organizations to coordinate startup operation
	4.2 Knowledge of items of preliminary confirmation for startup operation
	4.3 Knowledge of items of confirmation after startup operation
	4.4 Knowledge of intake restart in the powerhouse and dam

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Operation**

Unit Cord: xxxxxxxxxxxxxx  
 Unit Name: Management of Patrol  
 Description: This competency unit is related to the patrol management about planning, activity and records for hydropower plant.

Competency Elements	Performance Criteria
1. Management of Patrol planning	1.1. Assessment of items and interval for patrol based on results of past patrol and maintenance records
	1.2. Assessment of items for extraordinary patrol in case of disaster
	1.3. Supervision on investigation of accident
	1.4. Assessment of organization for patrol
2. Management of Patrol activity	2.4. Understanding of target range
	2.5. Supervision on countermeasures in the event of detection of abnormal condition
	2.6. Assessing the results in accordance with safety requirements
3. Management of Patrol records	3.1 Understanding of items for patrol records
	3.2 Management of accountable records
	3.3 Assessment of storage condition of patrol records



**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Operation**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Restoration planning

Description: This competency unit is related to the initial response of the restoration activities when the emergency situations happened

Competency Elements	Performance Criteria
1. Restoration planning	1.1 Analysis of trouble
	1.2 Understanding of restoration work contents and procedures
	1.3 Organization of restoration team
	1.4 Providing instruction of restoration work plan
2. Temporary restoration	2.1 Understanding of facility's condition and configuration
	2.2 Grasping of impact area, relevant divisions and organizations
	2.3 Providing instruction on temporary restoration measures
	2.4 Publicity of countermeasures

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Civil)**  
**Group: Operation**

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Restoration works

Description: This competency unit is related to the restoration works and analysis and reporting when the emergency situations happened

Competency Elements	Performance Criteria
1. Restoration works	1.1 Understanding of restoration works contents
	1.2 Understanding of trouble cause and countermeasure
	1.3 Publicity of countermeasures
	1.4 Supervision on restoration work progress and installation conditions
	1.5 Supervision on countermeasures against recurrence
2. Accident report	2.1 Knowledge of relevant divisions and organizations to report
	2.2 Supervision on investigation of accident
	2.3 Supervision on compiling initial accident report
	2.4 Assessment of accountable term
	2.5 Management of application deadline

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**

**Group: Operation**

Hydro Power  
 (Operation 1)  
 Operation Planning

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Operation planning

Description: This competency unit is related to the operation planning management about supply and demand, power system, power station and operation plan for hydropower plant.

Competency Elements	Performance Criteria
1. Knowledge of supply and demand	1.1 Knowledge of frequency and voltage control
	1.2 Knowledge of supply and demand management in normal condition
	1.3 Knowledge of countermeasure for supply and demand balance tight
2. Knowledge of power system	2.1 Understanding of supply and demand role of relevant power station in the power system
	2.2 Understanding of supply and demand characteristic of relevant power system
3. Knowledge of power station	3.1 Understanding of facility configuration
	3.2 Understanding of characteristic of relevant power plant
	3.3 Understanding of operation permit matter of relevant power plant
4. Assessment of operation plan	4.1 Knowledge of statutory inspection, inspection items and period
	4.2 Understanding of maintenance plan for relevant power station
	4.3 Assessment of long term operation plan
	4.4 Assessment of monthly and yearly operation plan
	4.5 Arrangement with load dispatch division for operation plan

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**

**Group: Operation**

Hydro Power
(Operation 2)
Maintenance
Planning

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of maintenance shutdown planning

Description: This competency unit is related to the maintenance shutdown planning management about assessment and supervision for maintenance shutdown and facility inspection for hydropower plant.

Competency Elements	Performance Criteria
1. Assessment of maintenance shutdown	1.1 Understanding of necessity and contents of maintenance works with shutdown
	1.2 Assessment of necessary outage duration and equipments for maintenance shutdown
2. Supervision on maintenance shutdown	2.1 Knowledge of relevant divisions and organizations to coordinate maintenance shutdown
	2.2 Supervision on shutdown management for maintenance work
3. Assessment of facility inspection	3.1 Understanding of necessity and contents of facility inspection
	3.2 Assessment of necessary inspection duration and equipments
	3.3 Assessment of organization for inspection
4. Supervision on facility inspection	4.1 Knowledge of relevant divisions and organizations to coordinate the inspection
	4.2 Supervision on operation management for inspection

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**

**Group: Operation**

Hydro Power (Operation 3) Management Operating Condition
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of operating condition

Description: This competency unit is related to the operating condition management about supervision and records for hydropower plant.

Competency Elements	Performance Criteria
1. Supervision on operation	1.1 Understanding of facility's operating condition
	1.2 Understanding of target range and environmental restrictions
	1.3 Providing instruction for maintaining proper conditions of facilities
	1.4 Assessment of conformity of relevant regulations
	1.5 Providing instruction of countermeasure against nonconformity
	1.6 Supervision on schedule of facility renovation
	1.7 Assessment of organization for operation
	1.8 Assessment of countermeasure for human error
2. Operation record management	2.1 Understanding of operating record items
	2.2 Management of accountable records
	2.3 Assessment of storage condition of operation records

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**

**Group: Operation**

Hydro Power  
(Operation 4)  
Operation Process

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of operating process

Description: This competency unit is related to the operating process management about procedure, supervision, control, startup and shutdown for hydropower plant.

Competency Elements	Performance Criteria
1. Management of Operational procedure	1.1 Knowledge of operating methods
	1.2 Understanding of startup/shutdown operation for power plant
	1.3 Assessment of operational procedures
	1.4 Assessment of organization to confirm operational procedures
2. Management of supervision and control	2.1 Ability of fault detection with meter, indicator and alarm
	2.2 Supervising on operation under dispatching order in line with procedure in manuals
	2.3 Supervising on countermeasures against abnormal in line with procedure in manuals
3. Management of shutdown operation	3.1 Knowledge of relevant divisions and organizations to coordinate shutdown operation
	3.2 Knowledge of items of preliminary confirmation for shutdown operation
	3.3 Knowledge of items of confirmation after shutdown operation
	3.4 Knowledge of earth connection
4. Management of start operation	4.1 Knowledge of relevant divisions and organizations to coordinate startup operation
	4.2 Knowledge of items of preliminary confirmation for startup operation
	4.3 Knowledge of items of confirmation after startup operation
	4.4 Knowledge of earth removal

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Operation**

Hydro Power (Operation 5) Patrol Management
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Unit Code: xxxxxxxxxxxxxx

Unit Name: Management of Patrol

Description: This competency unit is related to the patrol management about planning, activity and records for hydropower plant.

Competency Elements	Performance Criteria
1. Management of Patrol planning	1.1. Assessment of items and interval for patrol based on results of past patrol and maintenance records
	1.2. Assessment of items for extraordinary patrol in case of disaster
	1.3. Supervision on investigation of accident
	1.4. Assessment of organization for patrol
2. Management of Patrol activity	2.1. Understanding of target range
	2.2. Supervision on countermeasures in the event of detection of abnormal condition
	2.3. Assessing the results in accordance with safety requirements
3. Management of Patrol records	3.1 Understanding of items for patrol records
	3.2 Management of accountable records
	3.3 Assessment of storage condition of patrol records

**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Elect**  
**Group: Operation**

Hydro Power (Operation 6) Restoration Planning
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Restoration planning

Description: This competency unit is related to the initial response of the restoration activities when the emergency situations happened

Competency Elements	Performance Criteria
1. Restoration planning	1.1 Analysis of trouble
	1.2 Understanding of restoration work contents and procedures
	1.3 Organization of restoration team
	1.4 Providing instruction of restoration work plan
2. Temporary restoration	2.1 Understanding of facility's condition and configuration
	2.2 Grasping of impact area, relevant divisions and organizations
	2.3 Providing instruction on temporary restoration measures
	2.4 Publicity of countermeasures



**Power Engineers Competency Standard**  
**Basic Group: Hydropower Generation (Mechanical & Electrical)**  
**Group: Operation**

Hydro Power (Operation 7) Restoration Works
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Unit Code: xxxxxxxxxxxxxx  
 Unit Name: Management of Restoration works  
 Description: This competency unit is related to the restoration works and analysis and reporting when the emergency situations happened

Competency Elements	Performance Criteria
1. Restoration works	1.1 Understanding of restoration works contents
	1.2 Understanding of trouble cause and countermeasure
	1.3 Publicity of countermeasures
	1.4 Supervision on restoration work progress and installation conditions
	1.5 Supervision on countermeasures against recurrence
2. Accident report	2.1. Knowledge of relevant divisions and organizations to report
	2.2. Supervision on investigation of accident
	2.3. Supervision on compiling initial accident report
	2.4. Assessment of accountable term
	2.5. Management of application deadline

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Operation**

T&S (Operation 1) T&S System Operation
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Unit Cord: xxxxxxxxxxxx

Unit Name: Supervising operation planning and procedures of T&S

Description: This competency unit is related to operation planning and procedures of Transmission and Substation based on the respective laws and regulations.

Competency Elements	Performance Criteria
1. Understanding the knowledge of planned outage works on T&S	1.1 Understanding the works of planned outage 1.2 Understanding the safety measurements during planned outage
2. Coordinating with relevant divisions about works at planed outages and power interruptions	1.1 Coordinating promptly with relevant divisions and organizations to keep safety and minimize planned outage time 1.2 Coordinating promptly with relevant divisions and organizations to conduct works during planned power interruption
3. Supervising on dispatch order on substations and understanding its various function on the system	1.1 Understanding type, function and other knowledge of substation 1.2 Ability of supervising substation in normal / abnormal condition 1.3 Ability of supervising on proper dispatch order on substation in normal condition 1.4 Ability of supervising on proper dispatch order on substation to restore its power
4. Judging appropriate measures to deal with contingency and making necessary coordination with relevant divisions	1.1 Ability of judging appropriate measures such as supervision and monitoring during normal/abnormal condition of Substation 1.2 Coordinating necessary measures with relevant divisions to deal with contingency situation and solve its problem

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Operation**

T&S
(Operation 2)
Power Supply
Operation Record

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Operational management for stable power supply of T&S systems

Description: This competency unit is related to the operational management of Transmission and Substation and the supervision appropriate measurement for stable power supply.

Competency Elements	Performance Criteria
1. Supervising on the status of substation facility operation	1.1 Supervising power condition of substation facility operation and judging problems 1.2 If it is not suitable, decide appropriate countermeasures and provide proper instruction for stable power supply.
2. Judging the appropriate target range operating parameters according to the regulations	2.1 Understanding target range operating parameters in each facility 2.2 Understanding specific regulations related to operation of substation 2.3 If it is not suitable, decide appropriate countermeasures and provide proper instruction to operators
3. Assessing operational record and judging it suitable or not	3.1 Assessing the operation records of substation and evaluate these data. 3.2 Supervising on the safe condition according to the regulation(environmentally, electrically and mechanically) 3.3 Keeping these records and store them properly

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Operation**

<p>T&amp;S          (Operation 3)          Emergency Response</p>
---

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Supervising and planning restoration activities during electric failures

Description: This competency unit is related to initial response of the restoration activities when the abnormal situations happened such as electric failures.

Competency Elements	Performance Criteria
1. Supervising restoration activities on T&S	1.1 Understanding the measurements against the electric failures and especially how to restore the power failures at initial stage 1.2 Providing proper instructions and directing operators to identify fault location 1.3 Understanding the know-how to investigate the failure causes and isolate the failure zone from power system 1.4 Understanding the prevention measures against cascade outage 1.5 Understanding safety and effective measurements for recovering to normal condition
2. Planning restoration activities on T&S	2.1 Preparing safe, efficient and speedy restoring plan 2.2 Dispatching and ordering the appropriate technicians to the site to restore the damaged facilities 2.3 Analyzing cause of power failures 2.4 Understanding preparing tools and alternative electric materials for restoring works

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Operation**

T&S
(Operation 4)
Restoration
Supervising
Reports

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Supervising restoration works during electric failures and report to authority

Description: This competency unit is related to the restoration works and analysis & reporting when the emergency situations happened such as electric failures.

Competency Elements	Performance Criteria
1. Supervising tentative restoration works on T&S	1.1 Understanding the proper tentative restoration measurements and ordering appropriate works to prevent from the extension of power outage area 1.2 Grasping the power supply situation and area in real time 1.3 Judging speedy the most appropriate measures considering the safety of workers
2. Supervising restoration works for recovering from electric faults on T&S	2.1 Understanding the method for recovering the normal electric system from electric faults 2.2 Supervising restoration works for system recovering from electric faults
3. Supervising compiling detail accident report to authority	3.1 Analyzing causes of power failure 3.2 Instructing measures to prevent from recurrence in future 3.3 Supervising detail report on the power failures including its causes and damages 3.4 Supervising proper condition of the tools and materials

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Operation**

T&S
(Operation 5)
Operational management
Facilities Management

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Facilities management and works scheduling of T&S

Description: This competency unit is related to the facility management, planned outage scheduling, and safety management for appropriate operational management

Competency Elements	Performance Criteria
1. Proper management of facilities by referring to facility data on T&S	1.1 Understanding actual facilities data in the site and its real time facilities condition 1.2 Understanding the most effective and economical facilities allocations 1.3 Understanding the weak point of the power networks
2. Planning scheduled maintenance works with power interruption on T&S	2.1 Understanding the most suitable period and considering the most safety timing for planned outage for maintenance in the year 2.2 Negotiating and coordinating with relevant divisions about planned outage schedule

**Power Engineers Competency Standard**

**Basic Group: Transmission and Substation  
Group: Operation**

T&S  
(Operation 6 )  
Protection relay's  
Management

Unit Cord: xxxxxxxxxxxx

Unit Name: Protection relay's Management and works scheduling of T&S

Description: This competency unit is related to the protection relay's management, planned outage scheduling, and safety management for appropriate operational management

<b>Competency Elements</b>	<b>Performance Criteria</b>
1. Understanding the function of protection relays	1.1 Understanding zone of protection relays and the methodology of protection co-ordination 1.2 Coordinating relevant divisions and organizations 1.3 Providing proper instruction for temporary counter measure against accidents
2. Providing instruction on facility management of protection relays	2.1 Understanding the theory of power system stability, voltage stability and power system reliability 2.2 Judging optimum condition of protection relays
3. Supervising periodical inspection according to historical records	3.1 Identifying necessary process of inspection for each type of facilities 3.2 Understanding indicators for evaluating of results 3.2 Judging the introduction of trend management and analysis
4. Preparing necessary measurements for locking-out of protection relays during planned power outages	4.1 Understanding the theory of power system protection 4.2 Understanding the planning scheduled maintenance works during planned power outages 4.2 Coordinating relevant divisions and organizations 4.2 Providing proper instruction for temporary counter measures against power failures

**Power Engineers Competency Standard**  
**Basic Group: Transmission and Substation**  
**Group: Operation**

T&S
(Operation 7)
Operational Management
Education/Training

Unit Cord: xxxxxxxxxxxx

Unit Name: Educational and training Management on T&S

Description: This competency unit is related to the educational and training management on T&S

Competency Elements	Performance Criteria
1. Supervision on planning and reporting on safety management on T&S	1.1 Planning safety education / training for company staff 1.2 Reporting the outline of these education/training to authorities 1.3 Encouraging the staff to have conscious for the safety
2. Planning and conducting technical training programs on T&S	2.1 Conducting OJT technical training for especially safety issue and safety works 2.2 Conducting simulation training on recovery works and measurement during accident



**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Operation**

Thermal (Operation 1) Operation Planning
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Operation planning

Description: This competency unit is related to the operation planning management about supply and demand, power system, power station and operation plan for thermal power plant.

Competency Elements	Work Capabilities
1. Knowledge of supply and demand	1.1 Knowledge of frequency and voltage control
	1.2 Knowledge of supply and demand management in normal condition
	1.3 Knowledge of countermeasure for supply and demand balance tight
2. Knowledge of power system	2.1 Understanding of supply and demand role of relevant power station in the power system
	2.2 Understanding of supply and demand characteristic of relevant power system
3. Knowledge of power station	3.1 Understanding of facility configuration
	3.2 Understanding of characteristic of relevant power plant
	3.3 Understanding of operation permit matter of relevant power plant
4. Assessment of operation plan	4.1 Knowledge of statutory inspection, inspection items and period
	4.2 Understanding of maintenance plan for relevant power station
	4.3 Assessment of long term operation plan
	4.4 Assessment of monthly and yearly operation plan
	4.5 Arrangement with load dispatch division for operation plan

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Operation**

Thermal (Operation 2) Maintenance Planning
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of maintenance shutdown planning

Description: This competency unit is related to the maintenance shutdown planning management about assessment and supervision for maintenance shutdown and facility inspection for thermal power plant.

Competency Elements	Work Capabilities
1. Assessment of maintenance shutdown	1.1 Understanding of necessity and contents of maintenance works with shutdown
	1.2 Assessment of necessary outage duration and equipments for maintenance shutdown
2. Supervision on maintenance shutdown	2.1 Knowledge of relevant divisions and organizations to coordinate maintenance shutdown
	2.2 Supervision on shutdown management for maintenance work
3. Assessment of facility inspection	3.1 Understanding of necessity and contents of facility inspection
	3.2 Assessment of necessary inspection duration and equipments
	3.3 Assessment of organization for inspection
4. Supervision on facility inspection	4.1 Knowledge of relevant divisions and organizations to coordinate the inspection
	4.2 Supervision on operation management for inspection

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Operation**

Thermal  
 (Operation 3)  
 Management of  
 Operation Condition

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of operating condition

Description: This competency unit is related to the operating condition management about supervision and records for thermal power plant.

Competency Elements	Work Capabilities
1. Supervision on operation	1.1 Understanding of facility's operating condition
	1.2 Understanding of target range and environmental restrictions
	1.3 Providing instruction for maintaining proper conditions of facilities
	1.4 Assessment of conformity of relevant regulations
	1.5 Providing instruction of countermeasure against nonconformity
	1.6 Supervision on schedule of facility renovation
	1.7 Assessment of organization for operation
	1.8 Assessment of countermeasure for human error
2. Operation record management	2.1 Understanding of operating record items
	2.2 Management of accountable records
	2.3 Assessment of storage condition of operation records

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Operation**

Thermal  
 (Operation 4)  
 Management of  
 Operation Process

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of operating process

Description: This competency unit is related to the operating process management about procedure, supervision, control, startup and shutdown for thermal power plant.

Competency Elements	Work Capabilities
1. Management of Operational procedure	1.1 Knowledge of operating methods
	1.2 Understanding of startup/shutdown operation for power plant
	1.3 Assessment of operational procedures
	1.4 Assessment of organization to confirm operational procedures
2. Management of supervision and control	2.1 Ability of fault detection with meter, indicator and alarm
	2.2 Supervising on operation under dispatching order in line with procedure in manuals
	2.3 Supervising on countermeasures against abnormal in line with procedure in manuals
3. Management of shutdown operation	3.1 Knowledge of relevant divisions and organizations to coordinate shutdown operation
	3.2 Knowledge of items of preliminary confirmation for shutdown operation
	3.3 Knowledge of items of confirmation after shutdown operation
	3.4 Knowledge of earth connection
4. Management of start operation	4.1 Knowledge of relevant divisions and organizations to coordinate startup operation
	4.2 Knowledge of items of preliminary confirmation for startup operation
	4.3 Knowledge of items of confirmation after startup operation
	4.4 Knowledge of earth removal

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Operation**

Thermal (Operation 5) Management of Patrol
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Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Patrol

Description: This competency unit is related to the patrol management about planning, activity and records for thermal power plant.

Competency Elements	Work Capabilities
1. Management of Patrol planning	1.1. Assessment of items and interval for patrol based on results of past patrol and maintenance records
	1.2. Assessment of items for extraordinary patrol in case of disaster
	1.3. Supervision on investigation of accident
	1.4. Assessment of organization for patrol
2. Management of Patrol activity	2.1. Understanding of target range
	2.2. Supervision on countermeasures in the event of detection of abnormal condition
	2.3. Assessing the results in accordance with safety requirements
3. Management of Patrol records	3.1 Understanding of items for patrol records
	3.2 Management of accountable records
	3.3 Assessment of storage condition of patrol records

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Operation**

Thermal  
 (Operation 6)  
 Management of  
 Restoring Planning

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Restoration planning

Description: This competency unit is related to the initial response of the restoration activities when the emergency situations happened

Competency Elements	Work Capabilities
1. Restoration planning	1.1 Analysis of trouble
	1.2 Understanding of restoration work contents and procedures
	1.3 Organization of restoration team
	1.4 Providing instruction of restoration work plan
2. Temporary restoration	2.1 Understanding of facility's condition and configuration
	2.2 Grasping of impact area, relevant divisions and organizations
	2.3 Providing instruction on temporary restoration measures
	2.4 Publicity of countermeasures

**Power Engineers Competency Standard**  
**Basic Group: Thermal power Generation**  
**Group: Operation**

Thermal  
 (Operation 7)  
 Management of  
 Restoration Works

Unit Cord: xxxxxxxxxxxxxx

Unit Name: Management of Restoration works

Description: This competency unit is related to the restoration works and analysis and reporting when the emergency situations happened

Competency Elements	Work Capabilities
1. Restoration works	1.1 Understanding of restoration works contents
	1.2 Understanding of trouble cause and countermeasure
	1.3 Publicity of countermeasures
	1.4 Supervision on restoration work progress and installation conditions
	1.5 Supervision on countermeasures against recurrence
2. Accident report	2.1. Knowledge of relevant divisions and organizations to report
	2.2. Supervision on investigation of accident
	2.3. Supervision on compiling initial accident report
	2.4. Assessment of accountable term
	2.5. Management of application deadline

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG xxxx**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	<b>Engineering Manager for construction of thermal power plant</b>
<b>Uraian Kualifikasi</b>	Engineering Manager (Thermal power) shall supervise the safety construction and its works of thermal power facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Construction Planning & Designing (Thermal power)
	Construction works (Thermal power)

**Unit Kompetensi Pilihan (minimal x dari xx)**

<b>Kode Unit</b>	<b>Judul Unit</b>



**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	<b>Engineering Manager for operation of thermal power plant</b>
<b>Uraian Kualifikasi</b>	Engineering Manager (Thermal power) shall supervise the safety operation of thermal power facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Stable Power supply (Thermal power)
	Restoration of facilities from accident (Thermal power)
	Operational management (Thermal power)

**Unit Kompetensi Pilihan (minimal x dari xx)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG xxxx**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	<b>Engineering Manager for maintenance of thermal power plant</b>
<b>Uraian Kualifikasi</b>	Engineering Manager (Thermal power) shall supervise the safety maintenance and its repairing works of thermal power facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Field inspection & Patrol (Thermal power)
	Repairing & Maintenance works (Thermal power)

**Unit Kompetensi Pilihan (minimal x dari xx)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Construction of Hydropower (Civil)
<b>Uraian Kualifikasi</b>	Engineering Manager (Hydropower: Civil) shall supervise the safety construction and its works of Hydropower (Civil) facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Planning & designing (Hydropower: Civil)
	Construction works (Hydropower: Civil)

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Operation of Hydropower (Civil)
<b>Uraian Kualifikasi</b>	Engineering Manager (Hydropower: Civil) shall supervise the safety operation of Hydropower (Civil) facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Power Supply (Hydropower: Civil)
	Restoration of facilities from accidents (Hydropower: Civil)
	Operational management (Hydropower: Civil)

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Maintenance of Hydropower (Civil)
<b>Uraian Kualifikasi</b>	Engineering Manager (Hydropower: Civil) shall supervise the safety maintenance and its repairing works of Hydropower (Civil) facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Field inspection & patrol (Hydropower: Civil)
	Repairing & maintenance works (Hydropower: Civil)

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Construction of Hydropower (Mechanical & Electrical)
<b>Uraian Kualifikasi</b>	Engineering Manager (Hydropower: Mechanical & Electrical) shall supervise the safety construction and its works of Hydropower (Mechanical & Electrical) facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Planning & designing (Hydropower: Mechanical & Electrical)
	Construction works (Hydropower: Mechanical & Electrical)

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Operation of Hydropower (Mechanical & Electrical)
<b>Uraian Kualifikasi</b>	Engineering Manager (Hydropower: Mechanical & Electrical) shall supervise the safety operation of Hydropower (Mechanical & Electrical) facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Stable Power Supply (Hydropower: Mechanical & Electrical)
	Restoration of facilities from accidents (Hydropower: Mechanical & Electrical)
	Operational management (Hydropower: Mechanical & Electrical)

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Maintenance of Hydropower (Mechanical & Electrical)
<b>Uraian Kualifikasi</b>	Engineering Manager (Hydropower: Mechanical & Electrical) shall supervise the safety maintenance and its repairing works of Hydropower (Mechanical & Electrical) facilities based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Field inspection & patrol (Hydropower: Mechanical & Electrical)
	Repairing & maintenance works (Hydropower: Mechanical & Electrical)

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

<b>Kode Unit</b>	<b>Judul Unit</b>



**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Construction of Transmission and Substation
<b>Uraian Kualifikasi</b>	Engineering Manager (T&S) shall supervise the safety construction and its works of T&S based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

<b>Unit Kompetensi Umum (must have)</b>	
<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

<b>Unit Kompetensi Inti (must have)</b>	
<b>Kode Unit</b>	<b>Judul Unit</b>
	Planning & Designing(T&S)
	Construction works(T&S)

<b>Unit Kompetensi Pilihan (minimal 3 dari 11)</b>	
<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Operation of Transmission and Substation
<b>Uraian Kualifikasi</b>	Engineering Manager (T&S) shall supervise the safety operation of T&S based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Stable Power Supply(T&S)
	Restoration of electric facilities from accidents(T&S)
	Operational management(T&S)

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Maintenance of Transmission and Substation
<b>Uraian Kualifikasi</b>	Engineering Manager (T&S) shall supervise the safety maintenance and its repairing works of T&S based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance wiht Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

<b>Kode Unit</b>	<b>Judul Unit</b>
	Field inspection & patrol(T&S)
	Repairing & maintenance works(T&S)

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

<b>Kode Unit</b>	<b>Judul Unit</b>

**TENAGA TEKNIK KETENAGALISTRIKAN  
 BIDANG PEMBANGKITAN TENAGA LISTRIK  
 SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	
<b>Sertifikat Kualifikasi</b>	
<b>Judul Kualifikasi</b>	Engineering Manager for Construction of Distribution Systems
<b>Uraian Kualifikasi</b>	Engineering Manager (Distribution System) shall supervise the safety construction and its works of distribution system based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

<b>Unit Kompetensi Umum (must have)</b>	
<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

<b>Unit Kompetensi Inti (must have)</b>	
<b>Kode Unit</b>	<b>Judul Unit</b>
	Planning & Designing of distribution system
	Construction works of distribution system

<b>Unit Kompetensi Pilihan (minimal 3 dari 11)</b>	
<b>Kode Unit</b>	<b>Judul Unit</b>

**KUALIFIKASI STANDAR KOMPETENSI  
TENAGA TEKNIK KETENAGALISTRIKAN  
BIDANG PEMBANGKITAN TENAGA LISTRIK  
SUB BIDANG OPERASI**

<b>Kode Kualifikasi</b>	KTL.xxx.xx.xxx.xx
<b>Sertifikat Kualifikasi</b>	V
<b>Judul Kualifikasi</b>	Engineering Manager for Operation of Distribution Systems
<b>Uraian Kualifikasi</b>	Engineering Manager (Distribution System) shall supervise the safety operation of distribution system based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

**Unit Kompetensi Umum (must have)**

Kode Unit	Judul Unit
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

**Unit Kompetensi Inti (must have)**

Kode Unit	Judul Unit
	Stable Power Supply of distribution system
	Restoration of distribution facilities from accidents
	Operational management of distribution system

**Unit Kompetensi Pilihan (minimal 3 dari 11)**

Kode Unit	Judul Unit

## KUALIFIKASI STANDAR KOMPETENSI

### KUALIFIKASI STANDAR KOMPETENSI TENAGA TEKNIK KETENAGALISTRIKAN BIDANG PEMBANGKITAN TENAGA LISTRIK SUB BIDANG OPERASI

<b>Kode Kualifikasi</b>	
<b>Sertifikat Kualifikasi</b>	
<b>Judul Kualifikasi</b>	Engineering Manager for Maintenance of Distribution Systems
<b>Uraian Kualifikasi</b>	Engineering Manager (Distribution System) shall supervise the safety maintenance and its repairing works of distribution system based on relevant laws, regulations and safety rules as the responsible manager, and shall provide necessary instruction to person concerned.

#### Unit Kompetensi Umum (must have)

<b>Kode Unit</b>	<b>Judul Unit</b>
	Knowledge of electricity
	Compliance with Safety Rules
	Planning of Construction and O&M
	Training of Staff
	Reporting to Authorities

#### Unit Kompetensi Inti (must have)

<b>Kode Unit</b>	<b>Judul Unit</b>
	Field inspection & patrol of distribution system
	Repairing & maintenance works of distribution system

#### Unit Kompetensi Pilihan (minimal 3 dari 11)

<b>Kode Unit</b>	<b>Judul Unit</b>