UNIVERSIDAD NACIONAL DE INGENIERIA

FACULTAD DE INGENIERIA MECANICA

METODOLOGIA DEL CONTROL DE COSTOS APLICADO EN EL PROCESO DE MONTAJE PARA LA AMPLIACION DE LA CENTRAL HIDROELECTRICA DEL CAÑON DEL PATO DE 150 MW A 240 MW

INFORME DE INGENIERIA

PARA OPTAR EL TITULO DE

INGENIERO MECANICO

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Dedicado a:

Mis padres y hermanos que me apoyaron en todo momento para poder culminar esta nueva etapa de mi vida.

METODOLOGIA DEL CONTROL DE COSTOS APLICADO EN EL PROCESO DE MONTAJE PARA LA AMPLIACION DE LA CENTRAL HIDROELECTRICA DEL CAÑÓN DEL PATO DE 150 MW A 240 MW

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PROLOGO

Si miramos a nuestro alrededor, observaremos una gran cantidad de empresas constructoras que operan dentro del territorio nacional, algunas nacionales y otras sucursales de grandes empresas extranjeras, que no cuentan con una adecuada organización operativa ni administrativa que les permita ponerse a la vanguardia del desarrollo tecnológico que va creciendo día a día. Debido a esto, muchas de ellas no han podido sobrevivir a los grandes cambios que se han venido sucediendo en los últimos años.

Hace algunos años atrás se viene escuchando un concepto muy usado en las diferentes actividades relacionadas a la ingeniería y sus procesos en los distintos campos de aplicación. El término al cual nos referimos es conocido con el nombre de re-ingeniería que de una u otra manera busca mejorar la eficiencia, eficacia y calidad en las distintas etapas de los procesos con el fin

de optimizar el uso de los recursos que tenemos disponibles para la ejecución de los mismos.

Este informe titulado "Metodología del Control de Costos Aplicado en el Proceso de Montaje para la Ampliación de la Central Hidroeléctrica del Cañón del Pato de 150 MW a 240 MW" desarrolla una metodología para poder controlar los costos en el proceso de montaje de una obra en la que están involucradas trabajos de ingeniería, obras civiles e instalaciones electromecánicas, de manera tal que se contribuya al mejoramiento de la administración de los recursos disponibles.

Para que se pueda comprender mejor los procedimientos que estamos definiendo, paralelamente al desarrollo del tema se están aplicando estos conceptos al proceso de montaje de la central hidroeléctrica del Cañón del Pato.

El presente trabajo está compuesto de 4 capítulos, cada uno de los cuales se ha desarrollado como sigue a continuación:

En el capítulo 1, "Introducción", se tratan los antecedentes, la memoria descriptiva y los alcances de la ampliación de la central del Cañón del Pato, de manera tal que se pueda tener un panorama claro del contexto en que se desarrollaron los trabajos del mencionado proyecto.

En el capítulo 2, “Organización de la Obra”, se muestra el esquema organizacional de la obra, así como las funciones de cada uno de los participantes.

En el capítulo 3, “Metodología del Control de Costos”, se desarrolla una metodología general para controlar los costos en un determinado trabajo de montaje.

En el capítulo 4, “Control de Costos en el Montaje de la C.H. del Cañón del Pato”, se aplica la metodología descrita en el capítulo anterior al proceso de montaje de la central del Cañón del Pato.

Adicionalmente, como parte de los anexos, se están adjuntado los planos mecánicos de la ampliación y algunas fotos del proceso constructivo para que se ilustre mejor el trabajo que se desarrolló la ampliación de la central del Cañón del Pato.

CAPITULO 1

INTRODUCCION

INTRODUCCION

1.1. UBICACION

La central hidroeléctrica del Cañón del Pato opera con aguas tomadas del Río Santa en el distrito de Huallanca, provincia de Huaylas, departamento de Ancash, región Chavín.

1.2. ANTECEDENTES

La central del Cañón del Pato es propiedad de Egenor, empresa que, antes de la ampliación de la central del Cañón del Pato, contaba con una capacidad de generación eléctrica de 427 MW. Dicha capacidad proviene de las centrales hidroeléctricas de Cañón del Pato (150 MW) y Carhuaquero (87 MW), así como de las centrales termoeléctricas de

Chimbote (67 MW), Trujillo (22 MW), Chiclayo (30 MW), Piura (50 MW), Paita (11 MW) y Sullana (10 MW). Luego de la ampliación de la central del Cañón del Pato, la capacidad de generación de Egenor se elevó de 427 MW a 517 MW.

La ampliación de la central del Cañón del Pato de 150 MW a 240 MW, así como el aumento en la generación de la central de Carhuaquero de 75 MW a 87MW, formaron parte del programa de expansión de 102 MW de Egenor para el año de 1999. Estos trabajos requirieron, adicionalmente:

- Una toma complementaria en el río Santa, para aliviar la mayor demanda en la toma existente de la central del Cañón del Pato. Esta toma permitió una reducción en las pérdidas de carga y facilitará los trabajos de mantenimiento.
- La ampliación de la Subestación Chimbote No 1, propiedad de ETECEN, agregando un nuevo transformador de 120 MVA para transferir los 90 MW adicionales producidos por la central del Cañón del Pato. Este trabajo fue realizado por Egenor con cargo a que ETECEN le reembolse por los gastos incurridos.

Estos proyectos de expansión representaron una inversión de US$ 100 millones, de los cuales US$ 40 millones fueron financiados directamente por Egenor y los US$ 60 millones restantes fueron

financiados con bonos corporativos emitidos por el estado peruano a un interés promedio de 8%.

La central del Cañón del Pato pertenece al Sistema Interconectado Centro-Norte (SICN), por lo que la energía eléctrica que produce, puede satisfacer los requerimientos de cualquier cliente de la costa peruana, o zonas adyacentes que se encuentre entre Piura (Zorritos) e Ica (Marcona).

En la central del Cañón del Pato, la energía eléctrica es producida en 13.8 KV, que luego es elevada a 138 KV para ser conducida, por medio de tres líneas de transmisión, a la subestación de Chimbote No1, donde la tensión es elevada a 220 KV para que se distribuya en el Sistema Interconectado Centro Norte.

1.3. AMPLIACION DE LA CENTRAL HIDROELECTRICA DEL CAÑON DEL PATO

Esta parte del plan de expansión se desarrolló mediante el reemplazo de las 6 turbinas y generadores existentes de 25 MW nominales, por grupos de 40 MW cada uno, para lo cual se determinó que las estructuras actuales tenían la suficiente capacidad para soportar el incremento del caudal requerido.

Para llevar a cabo el presente trabajo se suscribió un contrato llave en mano con Asea Brown Boveri (ABB) para el desarrollo de la ingeniería, suministro e instalación de los equipos. ABB, a su vez, subcontrató a GyM para el desarrollo de la ingeniería y la instalación de los equipos, con quienes se estableció un cronograma de trabajo en el que se definió que las turbinas y generadores existentes serían reemplazados por pares en tres etapas de construcción. Para tal efecto GyM proporcionó un modelo hidráulico que se utilizó para fijar las modificaciones en la disposición del túnel de descarga y recolección.

1.4. ALCANCE DE LOS TRABAJOS DE GYM

Los alcances incluidos en el desarrollo del presente trabajo son:

- Demolición, remoción y disposición de las cimentaciones existentes, así como de los trabajos electromecánicos requeridos.
- Modificaciones necesarias de las instalaciones civiles para que se puedan acomodar las nuevas instalaciones incluyendo:

  Reforzar las fundaciones de concreto, paredes y lozas para los grupos turbina - generadores y sus equipos accesorios.

  Ampliación del túnel de colección y de descarga.
- Instalación de los equipos electromecánicos incluyendo:

  Las turbinas y todos sus equipos accesorios.

  Los generadores y todos sus equipos accesorios.

Equipos eléctrico auxiliares y accesorios.

- Modificación del sistema de enfriamiento por agua y ventilación de la sala de máquinas.
- Recepción, descarga, almacenamiento temporal, mantenimiento e instalación de todos los suministros a ser instalados bajo los alcances del presente contrato.

CAPITULO 2

ORGANIZACION DE LA OBRA

CAPITULO 2

ORGANIZACIÓN DE LA OBRA

2.1. ORGANIGRAMA DE LA OBRA

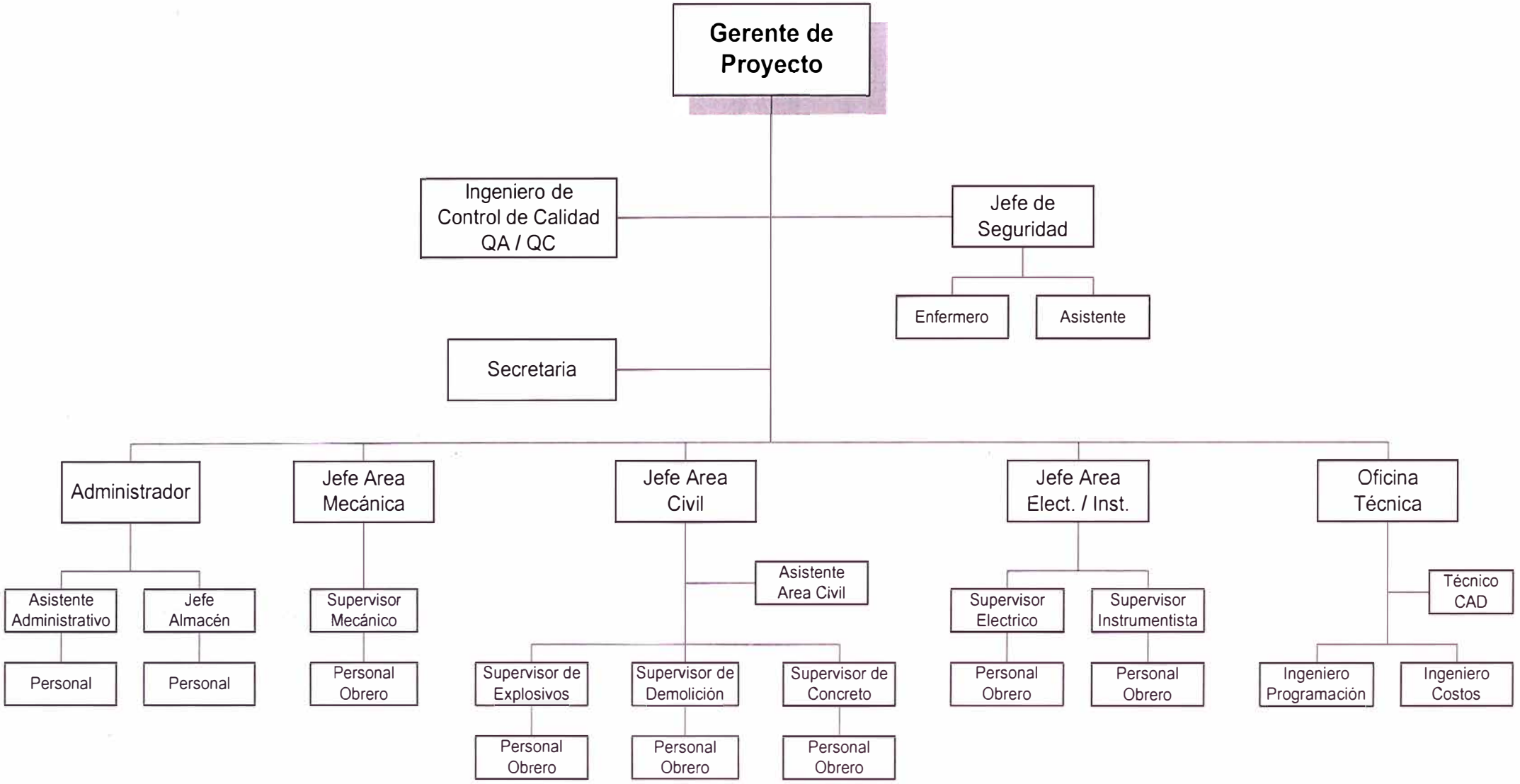
El organigrama es un esquema que representa la organización del personal que participa en las diversas labores de una empresa. En él se puede observar la cadena de mando que se establece para la adecuada coordinación de las actividades a realizarse.

En el caso de la ampliación de la central hidroeléctrica del Cañón del Pato, el organigrama está liderado por el gerente del proyecto, el cual tiene a su cargo 5 grupos de trabajo, dentro de los cuales se encuentran los grupos de producción directa (área civil, mecánica y eléctrica), la administración y la oficina técnica. También forman parte del presente organigrama los grupos de apoyo, tales como los

departamentos de seguridad y control de calidad, además de una secretaria. En la Fig. 3.1 podemos observar el organigrama de la obra.

FIG. 3.1 ORGANIGRAMA DE OBRA

AMPLIACION CAÑON DEL PATO



2.2. FUNCIONES DE LOS PARTICIPANTES

2.2.1. Gerente de Proyecto

- Manejo contractual.
- Relación con el cliente y entendimiento de sus necesidades.
- Definir metas y evaluar el personal.
- Gestión de obra, es decir, seguimiento y control en todas las áreas del proyecto: producción (civil, mecánica y eléctrica), administración (contabilidad, almacén y personal), oficina técnica (costos y programación) y seguridad.
- Revisar los informes de control de obra elaborados por la oficina técnica (costos y producción)
- Mantener informada a la oficina principal en Lima del desarrollo de la obra.
- Autorizar trámites bancarios junto con el administrador.

2.2.2. Ingeniero de Control de Calidad

- Elaborar el plan de control de la calidad y verificar su cumplimiento.
- Apoyar a la residencia de obra con el control de los documentos y registros de calidad, en el planeamiento de las actividades de inspección y control, desarrollo de los procedimientos constructivos, análisis de resultados para toma de decisiones, propuesta y seguimiento de acciones correctivas.

- Soporte técnico y operativo al personal de la obra.
- Verificar que se cumplan con todos los procedimientos del sistema de calidad aplicables.

2.2.3. Ingeniero de Seguridad

- Adecuar a la obra específica las normas, estándares y políticas de: Seguridad de Planta, Seguridad Industrial, Higiene Industrial y Medio Ambiente.
- Supervisar el cumplimiento de dichas normas.
- Dar el soporte técnico y operativo al personal de obra.
- Implementar (diseñar, poner en marcha y supervisar) sistemas de prevención (controles de ingreso y salida de personal, equipo y materiales; capacitación, etc.)
- Efectuar auditorías periódicas de seguridad en la obra.
- Ayudar al personal de obra a identificar riesgos (peligros potenciales)

2.2.4. Asistente de Seguridad

- Reemplazar al ingeniero de seguridad cuando éste no se encuentre dentro de las instalaciones de la obra.
- Apoyo en la inspección y control sobre los trabajos en ejecución.
- Apoyo en las charlas de seguridad.

2.2.5. Enfermero

- Atención al personal obrero por enfermedades.
- Dar primeros auxilios al personal en caso ocurriera algún tipo de accidente.
- Visitar e inspeccionar periódicamente las zonas de trabajo.
- Mantener constante la cantidad de los medicamentos en la obra.

2.2.6. Secretaria

- Control del ingreso y salida de los documentos de la obra.
- Mantener en orden todos los archivos de obra.
- Distribución de documentos al personal empleado.

2.2.7. Jefe de Area

- Responsable de la producción de su área, controlando la planificación, costos y avance de la misma.
- Elaborar los planes de movilización y desmovilización de su área.
- Prevención de riesgos y gestión ambiental.
- Cumplir los procedimientos de control de calidad.
- Negociación de subcontratas y equipos.
- Mejora continua de la productividad (estudio de métodos)
- Análisis de reportes de control de rendimientos/costos.

- Desarrollar procesos constructivos y alternativas a los mismos.
- Preparar el requerimiento de recursos.
- Revisar los partes diarios de tareo de su área (mano de obra, equipos, producción)
- Validación de metrados de avance.
- Topografía, laboratorio y pruebas de su área.
- Evaluación y certificación del personal de campo.
- Control de equipos propios (mantenimiento preventivo y reparación)

2.2.8. Ingeniero Asistente

- Reemplazar al jefe de área cuando éste no se encuentre dentro de las instalaciones de la obra
- Coordinar con el jefe de área los procedimientos constructivos a emplear.
- Determinación de los metrados para control y solicitud de materiales.
- Verificar el trabajo del personal obrero dentro de las instalaciones de la obra.

2.2.9. Supervisor

- Responsable de realizar los trabajos directamente en el campo.

- Comunicar y/o prevenir al jefe de área sobre la necesidad o exceso de recursos.
- Verificar que el personal obrero cumpla con las actividades diarias programadas.

2.1.10. Personal Obrero

- Es la fuerza laboral para la ejecución de todos los trabajos de la obra.

2.1.11. Jefe de Oficina Técnica

- Reemplazar al gerente del proyecto, cuando éste no se encuentre dentro de las instalaciones de la obra.
- Preparar especificaciones para compras técnicas.
- Revisar los informes preparados dentro de la oficina técnica (costos y de programación)
- Manejo de documentación técnica del propietario.
- Resolver conflictos durante la construcción.
- Compatibilización de planos.
- Preparar el relatorio de la obra.

2.1.12. Ingeniero de Programación, Planeamiento y Control

- Seguir el proceso de planeación mensual, control y proyecciones.

- Consolida y compatibiliza los programas semanales de los ingenieros de campo.
- Seguimiento al cronograma del proyecto.
- Validación y generación de información de control.
- Control de producción y productividad en la obra.
- Estudios de productividad.

2.1.13. Ingeniero de Costos

- Administración del contrato.
- Control del presupuesto.
- Elaboración de valorizaciones.
- Elaboración de presupuestos adicionales.
- Manejo de costos unitarios
- Preparar reportes de análisis de costos y resultados económicos.
- Apoyo a los jefes de área en negociaciones de subcontratas y equipos.

2.1.14. Técnico en CAD

- Mantenimiento y actualización de la planoteca.
- Elaboración de los planos as built (como construido) de la obra.
- Información gráfica y técnica necesaria para el proyecto.

- Control y numeración del ingreso y salida de planos, documentación técnica.
- Elaboración de sketch o record drawings.

2.1.15. Administrador

- Responsable de las políticas de la empresa y de la obra.
- Elaboración y manejo del flujo real y proyectado en coordinación con la oficina técnica.
- Adecuación y difusión de procesos administrativos.
- Supervisar el sistema de planilla de obreros (SISPO), así como realizar todos los trámites relacionados con éste, tales como trámites con el IPSS, Ministerio de Trabajo, AFP, etc.
- Revisar la legislación vigente con relación a Construcción Civil.
- Aperturar cuentas de ahorro en el banco para efectuar el depósito de los salarios del personal que labora en las instalaciones de la obra.
- Responsable del SISCO (sistema de contabilidad de la obra)
- Encargado de todo el proceso administrativo de las compras (desde la orden de compra hasta el pago)
- Control de pagos y cobranzas al personal obrero, proveedores, y subcontratistas.
- Ejecutar operaciones bancarias y controlar los cargos y abonos registrados en los estado bancarios

- Contratación de seguros.
- Administración de activos en la obra.
- Auditar la gestión del área de logística.
- Responsable de la casilla de correo electrónico de la obra.
- Responsable de la red (de computadoras) de la obra.
- Entrega de balances a la oficina principal.
- Encargado de coordinar los servicios de alimentación del personal obrero y staff, así como la limpieza de los campamentos y oficinas de la obra.
- Cruzar la información con el ingeniero de costos, de tal manera que no haya diferencias entre los reportes emitidos por ambas áreas.
- Informar o dar alerta inmediatamente cuando se haya incumplido con alguna obligación tributaria, con la finalidad de poder subsanar eficazmente la falta con la oficina principal.

2.1.16. Jefe de Almacén

- Encargado del manejo del SISAL (sistema de control de almacenes)
- Atender, solicitar y hacer seguimiento a los requerimientos de obra.
- Informar la llegada de materiales y el stock de los mismos.
- Llevar el inventario de la obra.

- Entregar reportes mensuales del consumo de materiales valorizados al departamento de costos de acuerdo a las partidas de control y a la contabilidad mediante asientos contables. Estos reportes los genera automáticamente el sistema (SISAL)

2.1.17. Asistente de Almacén

- Recepción y despacho de materiales dentro de las instalaciones de la obra.
- Verificar el ingreso de materiales que ingresan y salen de las instalaciones de la obra de acuerdo a las guías de remisión.
- Ordenar y clasificar los materiales de acuerdo a los requerimientos de la obra.

2.1.18. Asistente Administrativo

- Encargado del ingreso de los documentos al sistema de contabilidad (SISCO)
- Ordenar y archivar las facturas de acuerdo a los módulos contables.
- Realizar trámites bancarios.

2.1.19. Encargado del Personal

- Inscripción del personal que laborará dentro las instalaciones de la obra.

- Encargado de ingresar los tareos diarios en el sistema de planilla de obreros (SISPO)
- Emitir reportes mensuales a la administración y a la oficina de costos de los costos acumulados de las horas hombre de acuerdo a las partidas de control.

CAPITULO 3

METODOLOGIA DEL CONTROL DE COSTOS

CAPITULO 3

METODOLOGIA DEL CONTROL DE COSTOS

3.1. REVISION DEL CONTRATO

La revisión del contrato es el primer tema que se debe tratar para poder llevar a cabo un adecuado control de costos de la obra, ya que en la revisión de éste encontraremos información comercial y técnica que nos permitirá tener un panorama bien definido acerca del alcance de los trabajos a desarrollarse y las penalidades en que pudiéramos incurrir si no cumpliéramos con alguna de las cláusulas que se fijan en éste.

3.1.1. Información Comercial

- Propietario y cliente.

- Tipo y modalidad de la oferta (suma alzada, precios unitarios, administración, llave en mano, etc.)
- Fechas hito del proyecto (inicio, fin, fechas de llegada de suministros por parte del cliente y/o propietario)
- Moneda e idioma de la propuesta.
- Forma de pago (adelanto, valorizaciones, retenciones fianzas, garantías, devoluciones, formula polinómica)
- Multas y penalidades.
- Licencias, permisos, cánones, derechos.
- Seguros (todo riesgo, terceros, etc.)
- Consorcio o sociedad temporal.
- Sujeción o jurisdicción legal del contrato
- Cláusula de fuerza mayor o caso fortuito.
- Cláusula de resolución de contrato.
- Cláusula de suspensión de trabajos.
- Cláusula de solución de diferencias (arbitrajes, conciliación, amigable componedor, etc.)
- Cláusula de trabajos adicionales.
- Cláusula de ampliación del plazo.

3.1.2. Información Técnica

- Alcances del trabajo (ingeniería, suministros, montaje, etc.)

- Suministros por parte del cliente (materiales, equipos) así como el cronograma de llegada de los mismos.
- Requerimiento de personal directo e indirecto por parte del cliente.
- Requerimiento de personal profesional y técnico especialista por parte del cliente.
- Requerimientos de seguridad (vigilancia) por el cliente.
- Trámites y permisos para el ingreso a las instalaciones de la obra.
- Pruebas y controles (formatos y procedimientos)
- Impacto ambiental.
- Normas de seguridad (primeros auxilios, contraincendio, etc.)
- Análisis de riesgo y confiabilidad operativa (HAZOP)
- Especificaciones técnicas.
- Procedimientos constructivos.
- Facilidades (campamentos, almacenes, talleres, agua, electricidad, comunicaciones, alojamiento, alimentación, transporte, canteras, accesos, botaderos, etc)
- Almacenamiento de materiales y equipos permanentes.
- Jerarquía de documentación.
- Condiciones del lugar (geográficas, climáticas, hidrológicas, etc.)
- Planos "As Built"
- Capacitación y entrenamiento del personal del cliente.
- Manuales y certificados requeridos por el cliente.

- Requerimientos de puesta en marcha por el cliente (pre-commissioning, commissioning, start up)
- Régimen de entrega de la obra.

3.2. PRESUPUESTO META

Una vez que se haya revisado bien el contrato, así como el presupuesto oferta o presupuesto del propietario (presupuesto que se presenta al cliente), se procede a elaborar el presupuesto meta.

El presupuesto meta es preparado por el gerente del proyecto en coordinación con el personal de la oficina técnica (ingeniero de costos e ingeniero de programación) y el ingeniero presupuestador.

La participación del ingeniero presupuestador es de mucha utilidad, ya que es la persona que ha tenido a su cargo la elaboración del presupuesto oferta, por lo que conoce bien los alcances y las consideraciones que se han tenido durante la elaboración del mismo.

El presupuesto meta difiere del presupuesto oferta por el ajuste de precios que se hacen en los diversos rubros del presupuesto, estos ajustes se ven plasmados principalmente en los gastos generales (se ajustan los precios presupuestados a los precios reales), la mano de

obra (variación en los rendimientos) y en los equipos (mejorar precios y optimizar uso).

En el presupuesto meta se muestra claramente el compromiso que hace el gerente del proyecto con la oficina principal. Podemos mencionar los dos aspectos fundamentales de este compromiso: la utilidad que dará la obra así como el plazo en que se desarrollará.

El presupuesto meta lo presenta el gerente del proyecto en una reunión de compromisos, donde da a conocer la obra a los principales funcionarios de la oficina principal con el fin de conseguir un mayor acercamiento y apoyo durante la ejecución, así como definir los objetivos del proyecto a ejecutar y comprometerse en seguirlos. En esta reunión también se presentan los posibles riesgos y oportunidades para que se puedan proponer acciones para poder mitigarlos y/o aprovecharlos.

3.3. PLAN TECNICO DE PARTIDAS (PTP)

Luego de haber preparado el presupuesto meta, se debe elaborar el plan técnico de partidas. El PTP es el conjunto de partidas de control que se emplearán para el adecuado control de la obra. Las partidas de control son actividades que se pueden controlar en forma rápida y eficiente, ya que describen claramente los trabajos que se van a

realizar; éstas pueden ser, en algunos casos, las partidas del presupuesto, sin embargo en la mayoría de los casos son partidas que agrupan varias partidas del presupuesto.

Es importante controlar todas las actividades de una obra. Sin embargo, para poder realizar este trabajo deberíamos tener un gran número de partidas de control que involucraría un mayor número de personas para el control de las mismas. Esta mayor cantidad de gente se reflejaría directamente en un incremento del costo, lo que ya no sería rentable para la obra.

Tener un adecuado control no significa controlar el 100% de nuestras actividades, sino controlar adecuadamente las partidas más importantes (mayor incidencia) dentro de nuestro presupuesto sin descuidar, por supuesto, el resto de las partidas que, sumadas en conjunto podrían tener una gran incidencia. Por esto, siempre se debe tratar de seleccionar las actividades más importantes de la obra y las demás agruparlas para poder tener un adecuado manejo y control sobre las mismas y no encarecer el costo del control de la obra.

El número de partidas de control es variable de acuerdo al tipo y magnitud de la obra. Se recomienda que el número de partidas de control no sea superior a 40, ya que se dificultaría el adecuado control de la obra.

Elaborado el PTP, se deben relacionar las partidas del presupuesto del propietario (PdP) con las partidas PTP (partidas de control), teniendo en cuenta que no debe de quedar ninguna partida del PdP que no esté ligada a una partida del PTP. Existen dos tipos de relaciones:

- Una partida del PdP se relaciona totalmente con una partida del PTP.
- Una partida del PdP de relaciona parcialmente con una partida del PTP.

3.4. SISTEMA DE CONTROL

Habiendo definido el PTP, se debe hacer una reunión interna entre el personal que va a participar en la obra, el gerente del proyecto, el ingeniero de seguridad, el ingeniero de control de calidad, los ingenieros de la oficina técnica (costos y programación), jefes de campo, supervisores, administrador, jefe de almacén y encargado de la planilla para informales acerca del plan técnico de partidas y definir como debe de ser el flujo de información y los procedimientos para los distintos trámites que se deben realizar tanto internamente como para con la oficina principal en Lima. Definidos los procedimientos y el flujo de información, se deben de elaborar los formatos necesarios para poder desarrollar un adecuado control de la obra.

3.5. SEGUIMIENTO DE OBRA

Durante la ejecución de la obra, el ingeniero de costos, debe coordinar con todas las áreas del campo y oficina para que se manejen adecuadamente las partidas de control y no desviar los costos, ya que si las partidas de control no se usan adecuadamente, los reportes que se arrojan mensualmente no reflejarán un resultado real de los trabajos desarrollados.

Dentro de los principales trabajos que debe desarrollar tenemos

- Controlar los costos en base a los parámetros establecidos, es decir, se debe controlar el costo de la mano de obra, los consumibles, las herramientas y los equipos mayores.
- Informar periódicamente a los jefes de campo y al gerente del proyecto de cómo están los costos reales con respecto a los del presupuesto.
- Elaborar las valorizaciones para presentarlas al cliente. Estas valorizaciones se hacen tomando referencia el PdP.
- Revisar y dar visto bueno a las valorizaciones preparadas por los subcontratistas.
- Entregar las provisiones de gasto a la contabilidad, ya que existen gastos de la obra que al momento de cerrar el mes contable

todavía no están facturados, por lo que la contabilidad no los tiene ingresados en sus asientos contables.

- Conciliar los reportes mensuales con la contabilidad, explicando claramente las diferencias que pudieran existir.
- Preparar los presupuestos adicionales para presentarlos al cliente.
- Elaborar los informes mensuales de costos para enviarlos a la oficina principal.
- Preparar el informe final de costos para adherirlo al relatorio final de obra.

3.6. INFORME FINAL DE COSTOS

En el informe final de costos, se debe incluir toda la información que se ha obtenido como resultado de la obra, incluyendo los trabajos adicionales y los cuadros comparativos entre los costos reales y costos proyectados.

CAPITULO 4

CONTROL DE COSTOS EN EL MONTAJE DE LA CENTRAL HIDROELECTRICA DEL CAÑON DEL PATO

CAPITULO 4

CONTROL DE COSTOS EN EL MONTAJE DE LA CENTRAL HIDROELECTRICA DEL CAÑON DEL PATO

4.1. REVISION DEL CONTRATO

Como se mencionó en el capítulo anterior, la revisión del contrato es un paso fundamental para poder llevar a cabo un adecuado control de costos. Después de haber revisado el contrato, que se muestra en el Anexo 1, se obtuvo gran cantidad de información técnica y comercial que fue de mucha ayuda para poder elaborar el presupuesto meta y llevar a cabo un adecuado control de costos. Los puntos más saltantes que podemos mencionar son los siguientes:

4.1.1. Información Comercial

- El propietario es Egenor S.A. y el cliente es Asea Brown Boveri S.A. (PEABB)
- La modalidad del contrato es a suma alzada.
- Las fechas hitos del proyecto son

Fecha de inicio de obra	01 de Mayo de 1998
Fin de la primera etapa	31 de Octubre de 1998
Fin de la segunda etapa	30 de Abril de 1999
Fin de la tercera etapa	09 de Noviembre de 1999

- La moneda oficial es el dólar americano (US$)
- El idioma oficial es el inglés.
- La forma de pago son valorizaciones mensuales que se han fijado durante la negociación del contrato. Estas valorizaciones se muestran en el cuadro 4.1. En este cuadro podemos observar que los pagos empieza a partir de abril del 97, ya que desde esa fecha se comenzó a desarrollar la ingeniería del proyecto.
- Si la entrega de las unidades no se efectúa de acuerdo a los hitos contractuales, el contratista deberá pagar una multa al propietario por cada día de retraso, incluyendo la fecha de entrega contractual y la fecha de entrega real de la unidad, de acuerdo al cuadro 4.2. El total de las penalidades impuestas al contratista no puede exceder del 30% del precio del contrato.

CUADRO 4.1

CRONOGRAMA DE VALORIZACIONES CONTRACTUALES

MES DEL PROYECTO	FECHA	VALORIZACION	
		PORCENTAJE	US$
1	Abril-97	5%	$195,481
2	Mayo-97		
3	Junio-97		
4	Julio-97	5%	$195,481
5	Agosto-97		
6	Septiembre-97		
7	Octubre-97	5%	$195,481
8	Noviembre-97		
9	Diciembre-97		
10	Enero-98	5%	$195,481
11	Febrero-98		
12	Marzo-98		
13	Abril-98	4%	$156,384
14	Mayo-98	4%	$156,384
15	Junio-98	4%	$156,384
16	Julio-98	4%	$156,384
17	Agosto-98	4%	$156,384
18	Septiembre-98	4%	$156,384
19	Octubre-98	4%	$156,384
20	Noviembre-98	4%	$156,384
21	Diciembre-98	4%	$156,384
22	Enero-99	4%	$156,384
23	Febrero-99	4%	$156,384
24	Marzo-99	4%	$156,384
25	Abril-99	4%	$156,384
26	Mayo-99	4%	$156,384
27	Junio-99	4%	$156,384
28	Julio-99	4%	$156,384
29	Agosto-99	4%	$156,384
30	Septiembre-99	4%	$156,384
31	Octubre-99	4%	$156,384
32	Noviembre-99	4%	$156,384
TOTAL		**100%**	**$3,909,610**

CUADRO 4.2

MULTAS Y PENALIDADES

UNIDADES	HITOS CONTRACTUALES	MULTA POR UNIDAD POR DIA (US$)
Primera Unidad	31 de Octubre de 1998	$9,800
Segunda Unidad	31 de Octubre de 1998	$9,800
Tercera Unidad	30 de Abril de 1999	$10,000
Cuarta Unidad	30 de Abril de 1999	$10,000
Quinta Unidad	9 de Noviembre de 1999	$27,000
Sexta Unidad	9 de Noviembre de 1999	$27,000

- Si el contratista entrega las unidades antes de los hitos contractuales, recibirá un bono por cada día de adelanto, incluyendo la fecha de entrega real, pero excluyendo la fecha de entrega contractual, tal como se muestra en el cuadro 4.3. Adicionalmente el contratista recibirá los siguientes bonos:

  Para el caso de la unidad 5, si durante el período comprendido entre la fecha de entrega real y la fecha de entrega contractual, el flujo de agua promedio alcanza valores entre 50.22 m^3/s y 60 m^3/s, el contratista recibirá, por cada día que se presente este suceso, un bono equivalente al producto de US$ 450 multiplicado por la diferencia entre el flujo de agua promedio alcanzado y 48 m^3/s; pero si el flujo promedio supera los 60 m^3/s el contratista recibirá, por cada día que ocurra, un bono de US$ 5,400.

  Para el caso de la unidad 6, si durante el período comprendido entre la fecha de entrega real y la fecha de entrega contractual, el flujo de agua promedio alcanza valores entre 62.22 m^3/s y 72 m^3/s, el contratista recibirá, por cada día que se presente este suceso, un bono equivalente al producto de US$ 450 multiplicado por la diferencia entre el flujo de agua promedio alcanzado y 60 m^3/s; pero si el flujo promedio supera los 70 m^3/s el contratista recibirá, por cada día que ocurra, un bono de US$ 5,400

CUADRO 4.3

PREMIOS

UNIDADES	HITOS CONTRACTUALES	MULTA POR UNIDAD POR DIA (US$)
Primera Unidad	31 de Octubre de 1998	$1,960
Segunda Unidad	31 de Octubre de 1998	$1,960
Tercera Unidad	30 de Abril de 1999	$2,000
Cuarta Unidad	30 de Abril de 1999	$2,000
Quinta Unidad	9 de Noviembre de 1999	$1,000
Sexta Unidad	9 de Noviembre de 1999	$1,000

Si el contratista termina la obra antes del plazo, recibirá el 25% del bono ganado por PEABB.

Sumando todas las posibilidades mencionadas anteriormente, el máximo bono que puede recibir el contratista no podrá exceder los US$ 750,000.

- Las licencias y los permisos requeridos para la construcción debían de ser obtenidos por el contratista, en este caso GyM S.A.
- Los seguros están a cargo del contratista. Los seguros requeridos para este trabajo son los siguientes:

  Seguro de trabajo y riesgo, que cubra a los trabajadores del contratista, hasta por un monto de US$ 2,000,000.

  Seguro que cubra daños a las personas o a las instalaciones de la obra, hasta por un monto de US$ 2,000,000.

  Seguro adicional que cubra pérdidas en exceso a las coberturas de las 2 pólizas mencionadas anteriormente, en un monto de US$ 5,000,000.

- El contrato se rige a la jurisdicción del Perú.
- Los hechos considerados como eventos de fuerza mayor incluyen, pero no están limitados a los actos de enemigos públicos, desastres naturales, terremotos, relámpagos, tormentas, lluvias severas inusuales, motines, guerras, incendios, inundaciones, accidentes, huelgas u otras disputas laborales (excluyendo los problemas laborales particulares de la

obra) que afecten directamente el trabajo o las instalaciones donde se están desarrollando los trabajos. Si ocurriera alguno de los eventos anteriormente mencionados, el contratista deberá comunicarlo inmediatamente a PEABB ya que si este hecho ocasionara algún retraso en el avance programado de la obra, el contratista estaría facultado de ampliar sus plazos contractuales en un número de días igual al retraso que tuvo por los sucesos mencionados. Sin embargo, el contratista no tendrá derecho a compensaciones económicas de ningún tipo.

- Con respecto a los trabajos adicionales, se pueden presentar las siguientes posibilidades:

  Si PEABB requiere algún trabajo adicional, el contratista deberá preparar una propuesta a suma alzada describiendo los trabajos a desarrollar, así como el impacto que tendría en el monto y plazos contractuales; y presentarlo a PEABB dentro de los 5 días útiles de recibido el requerimiento para su aprobación.

  Si el contratista considera que algún trabajo a desarrollarse, no está considerado dentro de los alcances del contrato, deberá preparar una propuesta a suma alzada describiendo los trabajos a desarrollarse, así como el impacto que tendría en el monto y plazos contractuales; y presentarlo a PEABB tan pronto como éste se presente. PEABB deberá, dentro de

los 10 días útiles de recibida la propuesta, confirmar si es que procede o no el trabajo adicional.

En el caso que PEABB autorice al contratista a desarrollar un trabajo adicional, sin haber aprobado el monto a suma alzada presentado para la ejecución del mismo, PEABB reembolsará al contratista el costo directo de todos los trabajos relacionados a éste más un mark up de 10% sobre el costo directo.

- En caso exista alguna disputa o controversia entre PEABB y el contratista, la parte agraviada deberá notificar a la otra parte dentro de los 10 días útiles de ocurrido el hecho. Cada parte, dentro de los 5 días útiles posteriores, deberá nombrar un representante para que se reúnan en las instalaciones de la obra u otro lugar de mutuo acuerdo para resolver el problema en mención. Si las partes, después de 30 días de realizada la reunión, no resuelven el problema, cada parte tendrá derecho a interponer una demanda por arbitraje final y obligatorio, la cual deberá ser conducida en Lima, Perú u otro lugar de mutuo acuerdo de las partes, de acuerdo a las actuales reglas de conciliación y arbitraje de la Cámara de Comercio Internacional. El arbitraje acordado deberá de desarrollarse en cualquier corte de la jurisdicción competente. La decisión que se dictamine en este proceso será final y obligatoria

4.1.2. Información Técnica

- El alcance consistió en desarrollar la ingeniería, las instalaciones electromecánicas y las obras civiles para la ampliación de la central, tal como se detalla en el capítulo 1, sección 1.4.
- Se debe elaborar un plan de construcción que debe ser presentado a PEABB para su revisión y aprobación, antes de comenzar los trabajos en las instalaciones de la obra.
- Los suministros, así como los materiales permanentes serán responsabilidad de PEABB.
- El contratista se encargará de la seguridad de las instalaciones de trabajo así como de la custodia de los equipos y materiales suministrados por el PEABB.
- El contratista deberá entregar mensualmente al cliente los siguientes reportes:

  El avance mensual de los trabajos.

  El estado de los suministros de materiales y equipos necesarios para la culminación de los trabajos.

  Una comparación entre el cronograma de trabajo actual y los hitos fijados por el cliente.

  Una evaluación de los problemas y deficiencias en el desarrollo de los trabajos y una descripción de las acciones correctivas planeadas para la solución de los mismos.

  Trabajo programado para el siguiente mes.

- El contratista estará a cargo del alojamiento, alimentación y transporte del personal obrero.
- El alojamiento para el personal staff lo proporcionará PEABB en las instalaciones del campamento de Egenor, mientras que la alimentación del mismo correrá por cuenta del contratista.
- La instalación de las oficinas, almacenes y talleres deberán considerarse por cuenta del contratista, sin embargo PEABB proporcionará las áreas para la ubicación de dichas facilidades.
- El mantenimiento de las vías de acceso es responsabilidad de PEABB.
- PEABB suministrará agua y energía eléctrica (13.8KV) en determinados puntos de las instalaciones de la obra. La distribución estará a cargo del contratista.
- Los planos "As Built" deberán ser suministrados por el contratista,
- La obra se entregará al cliente en 2 modalidades:

  Entrega parcial, cuando se acabe cada etapa de la obra.

  Entrega final, cuando se culminen las 3 etapas de la obra.
- El comissioning y la puesta en marcha estará cargo de PEABB, sin embargo el contratista deberá suministrar el personal de apoyo necesario.

4.2. PRESUPUESTO META

Durante el período en que se estaba desarrollando la ingeniería del proyecto, se detectó que era necesario la ejecución de trabajos que no estaban incluidos en los alcances del proyecto, por lo que GyM presentó varios presupuestos adicionales para la ejecución de los mismos.

Al momento que empezaron los trabajos de montaje, PEABB solo había aprobado los siguientes adicionales:

- Ampliación del foso del generador.
- Excavación adicional para localizar los HPCU (unidad de control de los sistemas hidráulicos) y los acumuladores.
- Ampliación del foso de la turbina.

Por lo expuesto anteriormente, al momento de elaborar el presupuesto meta, el precio de venta del presupuesto se elevó de US$ 3,909,610 a US$ 4,097,020.

Por otro lado, el costo del presupuesto meta se elevó a US$ 6,097,348.39 tal como se muestra en el cuadro 4.4. Este aumento en el costo se produjo básicamente debido a:

- Las condiciones geológicas encontradas resultaron ser diferentes a las previstas originalmente en la propuesta, por lo que se tuvo

CUADRO 4.4
PRESUPUESTO META

PARTIDAS		UND	CANT	C. UNIT US$	C. TOTAL US$
05	**Supervisión Directa de Obra**				
050001	Supervisión Directa de Obra	glb	1.00	$695,134.57	$695,134.57
10	**Movilización y desmovilización**				
100001	Movilización y desmovilización	glb	1.00	$192,884.68	$192,884.68
100002	Campamentos	glb	1.00	$233,400.00	$233,400.00
12	**Ingeniería del Proyecto**				
120001	Ingeniería del Proyecto (GMI)	glb	1.00	$250,000.00	$250,000.00
15	**Seguridad**				
150001	Implementos y equipos de seguridad	glb	1.00	$88,200.42	$88,200.42
150002	Medicinas	glb	1.00	$10,000.00	$10,000.00
20	**Obras Civiles**				
200001	Obras civiles	glb	1.00	$1,598,830.87	$1,598,830.87
25	**Obras Mecánico Eléctricas**				
250001	Obras mecánico eléctricas	glb	1.00	$1,606,920.71	$1,606,920.71
50	**Gastos Generales**				
500001	Gastos Generales	glb	1.00	$1,191,977.14	$1,191,977.14
55	**Gestión Extraordinaria**				
552000	Egresos Financieros	glb	1.00	$230,000.00	$230,000.00
COSTO TOTAL (US$)				**$6,097,348.39**	

que modificar los procedimientos para las excavaciones en roca, y aumentar los volúmenes de concreto para las cimentaciones.

- Los gastos generales y las supervisión de obra considerados en el presupuesto aumentaron debido al incremento de los trabajos mencionados anteriormente.
- Los equipos considerados en el momento de la etapa de la elaboración de la propuesta no estaban disponibles; motivo por el cual se tuvieron que contratar equipos a un costo mas elevado.

El detalle del presupuesto meta se muestra en el anexo B.

4.3. PLAN TECNICO DE PARTIDAS

El plan técnico de partidas que se definió para el control de los trabajos, se muestra en el cuadro 4.5.

CUADRO 4.5

PLAN TECNICO DE PARTIDAS

CODIGO	DESCRIPCIÓN
05	**SUPERVISION DIRECTA DE OBRA**
050001	SUPERVISION DIRECTA DE OBRA
10	**MOVILIZACION Y DESMOVILIZACION**
101	**MOVILIZACION**
101001	PERSONAL
101002	EQUIPOS
102	**DESMOVILIZACION**
102001	PERSONAL
102002	EQUIPOS
103	**CAMPAMENTOS**
103001	INSTALACION Y/O HABILITACION
15	**SEGURIDAD**
150001	IMPLEMENTOS Y EQUIPOS DE SEGURIDAD
150002	MEDICINAS
20	**OBRAS CIVILES**
201	**DEMOLICION Y EXCAVACION**
201001	BASE DE TURBINA Y GENERADOR
201002	NICHO DE BOQUILAS, HPCU Y ACUMULADORES
201003	GALERIA DE CABLES, REUBICACION DE BANDEJAS
201004	CIMENTACION DE TRANSFORMADORES Y MURO CONTRA INCENDIOS
201005	CANAL DE DESCARGA
201006	TUNEL NUUEVO ADICIONAL
202	**ACERO DE REFUERZO**
202001	BASE DE TURBINA Y GENERADOR
202002	NICHO DE BOQUILAS, HPCU Y ACUMULADORES
202003	GALERIA DE CABLES, REUBICACION DE BANDEJAS
202004	CIMENTACION DE TRANSFORMADORES Y MURO CONTRA INCENDIOS
202005	CANAL DE DESCARGA
202006	TUNEL NUUEVO ADICIONAL
203	**INSERTOS METALICOS**
203001	TURBINAS Y GENERADORES
203002	MURO CONTRA INCENDIOS
204	**ENCOFRADO**
204001	BASE DE TURBINA Y GENERADOR
204002	NICHO DE BOQUILAS, HPCU Y ACUMULADORES
204003	GALERIA DE CABLES, REUBICACION DE BANDEJAS
204004	CIMENTACION DE TRANSFORMADORES Y MURO CONTRA INCENDIOS
204005	CANAL DE DESCARGA
204006	TUNEL NUUEVO ADICIONAL
205	**CONCRETO**
205001	BASE DE TURBINA Y GENERADOR
205002	NICHO DE BOQUILAS, HPCU Y ACUMULADORES
205003	GALERIA DE CABLES, REUBICACION DE BANDEJAS
205004	CIMENTACION DE TRANSFORMADORES Y MURO CONTRA INCENDIOS
205005	CANAL DE DESCARGA
205006	TUNEL NUUEVO ADICIONAL

CUADRO 4.5

PLAN TECNICO DE PARTIDAS

CODIGO	DESCRIPCIÓN
206	**OTROS**
206001	SHOTCRETE EN BOVEDA Y PAREDES
206002	TAPON TIPO BKH
206003	ANCLAJES PARA CIMENTACION
206005	ACABADOS
206006	PANTALLAS DE PROTECCION
25	**EQUIPOS**
250001	DESMONTAJE
250002	MONTAJE
250003	PRUEBAS
30	**ELECTRICIDAD**
300001	DESCONEXIONADO
300002	CONEXIONADO
300003	SISTEMAS A TIERRA
300004	TENDIDO DE BANDEJA DE CABLES
300005	INSTALACION DE TUBERIA CONDUIT
300006	CABLEADO DE FUERZA
300007	CABLEADO DE CONTROL
300008	PRUEBAS
35	**INSTRUMENTACION**
350001	DESMONTAJE DE INSTRUMENTOS
350002	MONTAJE DE INSTRUMENTOS
350003	INSTALACION DE TUBING
350004	CONEXIONADO
350005	PRUEBAS
40	**TUBERIAS Y ACCESORIOS**
400001	DESMONTAJE DE INSTRUMENTOS
400002	MONTAJE DE INSTRUMENTOS
400003	INSTALACION DE TUBING
41	**TRANSPORTE Y ACARREO DE MATERIALES**
410001	EQUIPOS Y TUBERIAS
410002	OBRAS CIVILES
410003	OBRAS ELECTRICAS
50	**GASTOS GENERALES**
500001	GASTOS GENERALES
55	**GESTION EXTRAORDINARIA**
551000	INGRESOS FINANCIEROS
552000	EGRESOS FINANCIEROS

4.4. SISTEMA DE CONTROL

Después de haber elaborado el presupuesto meta y el plan técnico de partidas, se citó a una reunión de coordinación, donde participaron el gerente del proyecto, el ingeniero de seguridad, el ingeniero de control de calidad, los ingenieros de la oficina técnica (costos y programación), jefes de campo, supervisores, administrador, jefe de almacén y encargado de la planilla. En esta reunión se dieron a conocer las partidas de control, así como los trabajos ligados a cada una de ellas. Adicionalmente, con relación al tema del control de costos, se definieron los siguientes procedimientos:

4.4.1. Control del Personal Obrero

El control del horario trabajo así como las labores realizadas por el personal obrero debería ser ejecutado por el tareador en coordinación con los supervisores y/o capataces. El formato utilizado para este control debía ser el parte diario de tareo, que se muestra en el cuadro 4.6. Una vez llenado el parte de tareo, indicando claramente la partida de control en la que participado cada miembro de la cuadrilla, éste tenía que ser visado por el jefe de cada área.

CUADRO 4.6
PARTE DE TAREO DE PERSONAL

GyM S.A.
LIMA - PERU
CAÑON DEL PATO EXPANSION

PARTE - DIARIO

Obra Civil ☐ Obra Eléctrica ☐ Obra Mecánica ☐	CUADRILLA : ..... JEFE CUADRILLA :	FECHA : / / TURNO: Día ☐ Noche ☐

Código	Nombre y Apellido	Categoría	Partida	H. Normales	H 60%	H 100%	T. Horas

Equipos mayores utilizados	H Máquina	Partida	Actividad	Unidad	Metrado	Total Horas
			HORAS TOTALES			

CAPATAZ RESPONSABLE

SUPERVISOR

PLANEAMIENTO

COSTOS

El parte de tareo debería ser llenado en original y 3 copias, y se distribuiría de la siguiente manera:

- El original debería ser entregado al encargado de personal para que lo ingresara al SISPO (sistema de planillas).
- Las copias deberían ser entregadas al jefe de cada área, al ingeniero de costos y al ingeniero de programación.

4.4.2. Control de Equipo Pesado

Estaría a cargo de los representantes del dueño del equipo. El formato utilizado para este control debía ser el parte diario de equipos, que se muestra en el cuadro 4.7. Luego que el parte de equipos haya sido llenado, indicando claramente las partidas de control en la que ha participado el equipo, éste tenía que ser visado por el jefe de cada área o los supervisores.

El parte de tareo debería ser llenado en original y 2 copias, y se distribuiría de la siguiente manera:

- El original debería ser entregado al jefe de cada área.
- Una copia se debía quedar con el representante del dueño y la otra entregarse al ingeniero de costos.

CUADRO 4.7
PARTE DE TAREO DE EQUIPOS

GyM S.A.
LIMA - PERU
Client : ASEA BROWN BOVERY
Project : CAÑON DEL PATO EXPANSION

PARTE DIARIO DE EQUIPO MECANICO

Fecha _____
Unidad _____ **Capacidad** _____
Marca _____ **Placa/Red.** _____
Propietario _____

HORAS DE TRABAJO

MAÑANA	TARDE	TOTAL
INGRESO _____	INGRESO _____	
SALIDA _____	SALIDA _____	
TOTAL _____	TOTAL _____	

Combustible y Lubricantes	
Gasolina _____	Hidrolina _____
Petróleo _____	Aceite Motor _____
Grasa _____	Aceite Trans. _____

Descripción del Trabajo

Horas Trabajadas _____
Labor Realizada _____
Partida _____
_____

_____ **Operador**

_____ **Supervisor**

_____ **Ing. Residente**

4.4.3. Control de Subcontratistas

La ejecución de los trabajos de las subcontratas deberían ser controlados por los jefes de cada área. Estos, a su vez, debían mantener constantemente informado al ingeniero de costos y de programación acerca del avance de las mismas.

Las valorizaciones debían ser presentadas al ingeniero de costos, para su revisión y visto bueno y posteriormente al administrador para el pago de las mismas.

4.4.4. Control de Materiales

Para la compra de materiales, se debía emitir un pedido de obra, indicando claramente la partida de control en la que debería cargado el material. Este pedido de obra debería ser visado por el gerente del proyecto y luego entregado al jefe del almacén. Inmediatamente de recibido el pedido de obra, el jefe de almacén debía ingresarlo al SISAL (sistema de almacenes), emitir una orden de compra para dicho pedido y entregar una copia de la orden al ingeniero de costos. Seguidamente se tenía que evaluar si la compra podría ser local; si este no fuera el caso se tenía que enviar una copia, vía fax, de la orden de compra a la persona encargada de la logística de la obra en la oficina principal (Lima).

Una vez que el material solicitado llegaba a las instalaciones de la obra, el jefe de almacén debía revisar si lo que había llegado estaba conforme al pedido que se hizo. Si todo estaba, se debía recibir el pedido, en caso contrario, debería devolverse inmediatamente. Posteriormente, el jefe de almacén debería ingresar los materiales al SISAL y comunicar inmediatamente la llegada de los mismos a la persona que los solicitó.

Para retirar los materiales del almacén se debía ingresar claramente, en el vale de salida de almacén, la partida de control en la que se va a utilizar. Las únicas personas autorizadas para retirar materiales del almacén serían el gerente del proyecto, los jefes de área, supervisores, administrador, jefe de oficina técnica, ingeniero de seguridad e ingeniero de control de calidad.

4.4.5. Control de Facturas

La secretaria, encargada de la recepción de todos los documentos de la obra, debía separar las facturas y entregarlas al ingeniero de costos para la revisión de las mismas; inmediatamente el ingeniero de costos debería revisar las facturas, ponerle su visto bueno y entregarlas al administrador para que las ingrese al SISCO (sistema de contabilidad) y se proceda con el pago de las mismas.

No se permitiría, en ningún caso, el pago de ninguna factura que no presente el visto bueno del ingeniero de costos.

4.5. SEGUIMIENTO DE OBRA

Para hacer el seguimiento de obra se utilizaron los siguientes programas:

SINCO	Sistema de control de costos.
SISCO	Sistema de contabilidad
SISPO	Sistema de control de planilla de obreros
SISAL	Sistema de control de almacenes
SISME	Sistema de control de equipos

Estos programas, propiedad de GyM, permiten que se realicen integraciones entre los mismos, es decir, los reportes del almacén (SISAL), de los equipos (SISME) y de las planillas (SISPO) se pueden descargar directamente en el sistema de costos (SINCO) o en el sistema de contabilidad (SISCO) de acuerdo a los requerimientos que se tengan.

4.6. INFORME FINAL DE COSTOS

En el resultado final de obra, mostrado en el cuadro 4.8, se observa que el margen final de la obra con respecto a los trabajos

CUADRO 4.8
RESULTADO FINAL DE OBRA

ITEM	DESCRIPCION	P. VENTA US$	COSTO US$	MARGEN	
				US$	%
01	Alcances del contrato	$4,097,020.00	$5,929,186.64	($1,832,166.64)	-44.72%
02	Trabajos Adicionales	$1,766,971.78	$1,521,702.34	$245,269.44	13.88%
TOTAL (US$)		**$5,863,991.78**	**$7,450,888.98**	**($1,586,897.20)**	**-27.06%**

contractuales fue de US$ -1,832,166.64 que representa el -44.72% del precio de venta contractual. Sin embargo, debido a la gran cantidad de adicionales que se desarrollaron, el margen negativo disminuyó, llegando hasta un valor de US$ -1,586,897.20 que representa el -27.06% del precio de venta final: US$ 5,863,991.78. El detalle del resultado final de la obra se presenta en el anexo C.

Si comparamos los resultados finales obtenidos con los pronosticados en el presupuesto meta, tal como se muestra en el cuadro 4.9, observaremos que en la mayoría de los rubros se ha logrado obtener ahorro, ya que los trabajos desarrollados en las tres etapas del proyecto eran similares, por lo que los rendimientos mejoraron etapa a etapa. Para poder mejorar estos rendimientos se tuvo que invertir un poco mas en el control de la obra, por lo que los gastos generales aumentaron.

CUADRO 4.9
RESULTADO COMPARATIVO FINAL

PARTIDAS		PRESUPUESTO META	PRESUPUESTO FINAL	AHORRO US$
05	**Supervisión Directa de Obra**			
050001	Supervisión Directa de Obra	695,134.57	$676,950.18	$18,184.40
10	**Movilización y desmovilización**			
100001	Movilización y desmovilización	192,884.68	$155,934.68	$36,950.00
100002	Campamentos	233,400.00	$233,400.00	
12	**Ingeniería del Proyecto**			
120001	Ingeniería del Proyecto (GMI)	250,000.00	$250,000.00	
15	**Seguridad**			
150001	Implementos y equipos de seguridad	88,200.42	$78,577.31	$9,623.11
150002	Medicinas	10,000.00	$10,000.00	
20	**Obras Civiles**			
200001	Obras civiles	1,598,830.87	$1,573,830.87	$25,000.00
25	**Obras Mecánico Eléctricas**			
250001	Obras mecánico eléctricas	1,606,920.71	$1,518,870.87	$88,049.84
50	**Gastos Generales**			
500001	Gastos Generales	1,191,977.14	$1,201,622.74	-$9,645.60
55	**Gestión Extraordinaria**			
552000	Egresos Financieros	230,000.00	$230,000.00	
AHORRO TOTAL (US$)				$168,161.75

CONCLUSIONES

CONCLUSIONES

1. Con una adecuada metodología para controlar los costos, se obtienen ahorros significativos en el resultado final de una obra. Por esta razón para obras de gran envergadura, las empresas deben de contar con un área técnica específica para que se dedique al control de costos y de la programación.

2. De los resultados obtenidos en la ampliación de la central hidroeléctrica del Cañón del Pato, podemos concluir que cuando se realiza un mismo trabajo varias veces, se optimizan los rendimientos y los costos asociados a estos.

3. Para obtener resultados positivos, las personas deben cumplir con las actividades asignadas. Si alguien falla, la cadena se rompe produciendo deficiencias en los procedimientos de control.

4. El personal encargado de ejecutar la obra debe tener conocimiento de los alcances de la obra para poder programar adecuadamente, evitando dejar de lado actividades que puedan generar un mayor costo.

5. Es necesario que los procedimientos constructivos estén claramente definidos antes de empezar la ejecución del proyecto para evitar atrasos y mayores costos.

BIBLIOGRAFIA

BIBLIOGRAFIA

GYM S.A., Manual de presupuestos, 2000

GYM S.A., Manual de gestión de obras, 2000

ASEA BROWN BOVERY S.A. / GYM S.A., Subcontract for civil engineering, construction and installation of the Cañon del Pato expansion between Asea Brown Boveri S.A. and GyM S.A., 1997

EGENOR S.A., Memoria anual, 1998

ANEXOS

ANEXO A

CONTRATO DE LA AMPLIACION DE LA CENTRAL HIDROELECTRICA DEL CAÑON DEL PATO

CONTRATO

CAÑON DEL PATO

Ingeniería, Construcción e Instalación

Central Hidroeléctrica de Cañón del Pato

CLIENTE : ASEA BROWN BOVERI

Nº **23121289**
Fecha : **01 de julio de 1997**
Obra : **AMPLIACION CENTRAL HIDROELECTRICA DE CAÑON DEL PATO**

El día **01/04/98**, de acuerdo a los datos consignados, se dará inicio a vuestra obra.

1.- DE LA OBRA:

Descripción: Ingeniería, Construcción e Instalación de la **Central Hidroeléctrica de Cañón del Pato**
Dirección: **Cañón del Pato, Huaylas, Ancash**

2.- ASOCIADOS

Nombre: Dirección:
Encargado: Teléfono:

3.- CLIENTE

Nombre: **ABB** Dirección: **Av. Argentina 3120, Cercado de Lima**
Encargado: **Ing. José Barbe**

4.- SUPERVISORES

Nombre: Encargado:
Teléfono:

5.- CONTRATO

Modalidad: **Suma Alzada** Fecha: **13 de junio de 1997**

6.- PRESUPUESTO

Monto Total: **US $3'909,610 (sin incluir I.G.V.)**
Plazo de Ejecución: Dieciocho **(18) meses**

7.- ORGANIZACION

Ingeniero Residente:

GyM S.A.

Luis Díaz Imiela-Gentimur
Gerente General

AGR ...

VV ...

OCG

c.c.: **Unidad Técnica** **Contabilidad**
CEQ **Finanzas**
Legal **Archivo General**
Supervisión

yMS.A.

GyM S. A.

DPTO. CONTABILIDAD

SUBCONTRACT

FOR

CIVIL ENGINEERING, CONSTRUCTION, AND INSTALLATION

OF THE

CAÑÓN DEL PATO EXPANSION

BETWEEN

ASEA BROWN BOVERI S.A.

AND

GyM S.A.

TABLE OF CONTENTS

Form of Performance Bond

TABLE 12.3 -- Estimated Long Term Average Flow Numbers

SUBCONTRACT
FOR
CIVIL ENGINEERING, CONSTRUCTION, AND INSTALLATION
OF THE
CAÑÓN DEL PATO EXPANSION

This Agreement for Civil Engineering, Construction, and Installation of the Cañon del Pato Expansion (this "Agreement"), dated as of June 13, 1997, is entered into by and between Asea Brown Boveri S.A.., a Peruvian company with its principal office in Lima, Peru ("PEABB"), and GyM S.A., a Peruvian company with its principal office in Lima, Peru ("Contractor").

RECITALS

A. In connection with the sale of the Class A Shares of Owner in an international public bidding process, Owner and certain of its shareholders undertook an obligation (such obligation, the "Expansion Obligation") to increase the generating capacity of Owner by one hundred (100) megawatts by the date specified by the Government of Peru. As a result of such obligation, Owner desires to have the Work (as defined herein) performed in a timely manner.

B. PEABB desires to engage an experienced, financially sound contractor to perform the Work on a fixed price basis.

C. Pursuant to the terms and subject to the conditions of this Agreement, PEABB desires to engage Contractor to perform the Work, and Contractor desires to accept such engagement.

NOW, THEREFORE, for and in consideration of the foregoing and the mutual covenants and agreements set forth herein, the receipt and sufficiency of which are hereby acknowledged, PEABB and Contractor hereby agree as follows:

1. THE CONTRACT DOCUMENTS

The Agreement consists of Sections 1 through and including 18 hereof and the Appendices, Exhibits and Tables listed in the Table of Contents, which are attached hereto and incorporated into and made a part of the Agreement by this reference. In the event of any conflict or inconsistency between Sections 1 through and including 18 hereof and any Appendix or Table hereto, the terms of Sections 1 through and including 18 hereof shall control.

2. DEFINITIONS

"Affiliated Company" shall mean, with respect to PEABB, a company which directly or indirectly controls, is controlled by or is under common control with PEABB. For the purposes of this definition, the term "control" (including, with correlative meanings, the terms "controlled by" and "under common control with" shall mean the possession, directly or indirectly of the power to direct or cause the direction of the management and policies of PEABB, whether through the ownership of voting securities, by contract or otherwise.

"Agreement" has the meaning set forth in the introductory paragraph hereof.

"Application for Progress Payment" has the meaning specified in Section 7.1.2.

"Business Day" means each day that is not a Saturday, Sunday or day on which banks in Lima, Peru are authorized or required to be closed.

"Change" shall mean any addition, deletion or other revision to the Work.

"Change Order" has the meaning specified in Section 8.1.

"Confidential Information" has the meaning specified in Section 15.

"Construction Plan" has the meaning specified in Section 3.21.

"Contract Milestone Schedule" has the meaning specified in Section 3.20.

"Contract Price" has the meaning specified in Section 7.1.

"Contractor" has the meaning specified in the introductory paragraph hereof.

"Documents" means all documents and drawing identified on the Document Delivery Schedule.

"Document Delivery Schedule" means the schedule for Contractor's delivery of Documents to Owner that is attached hereto as Appendix D, as such schedule may be amended to a final form which shall be mutually agreed upon by the parties within sixty (60) days of the date hereof.

"Dry Period" means the period from and including May 1 to and including November 30.

"Early Completion Bonus" has the meaning specified in Section 12.3.

"Early Completion Bonus Period" has the meaning specified in Section 12.3.

"Engineer" means Acres International Corporation.

"Event of Default" has the meaning specified in Section 11.1.

"Expansion Obligation" has the meaning specified in the Recitals.

"Facility" means the Owner's hydroelectric generating facility located in Cañon del Pato, Huaylas Province, Peru.

"Facility Site" means the site on which the Facility is located in Cañon del Pato, Huaylas Province, Peru.

"Fifth Unit Daily Bonus" has the meaning specified in Section 12.3.2.

"Final Completion" has the meaning specified in Section 6.5.

"Final Completion Date" has the meaning specified in Section 6.5.5.

"Final Completion Holdback" has the meaning specified in Section 7.1.4.

"Force Majeure Event" has the meaning specified in Section 14.1.

"Governmental Authority" shall mean the governments of the United States of America and Peru and any state, commonwealth, province, territory or possession of either such nation and any political subdivision of any of the foregoing, including, without limitation, courts, departments, commissions, boards, bureaus, agencies or other instrumentalities of any of the foregoing.

"Hazardous Material" means any chemicals, pollutants, contaminants, wastes or toxic substances, the release, discharge, handling, storage, transportation or emission of which is subject to limitation or regulation under applicable laws, rules or regulations.

"Interest Rate" means, the rate of interest from time to time publicly announced by The Chase Manhattan Bank, N.A., New York, New York, as its prime commercial lending rate, computed monthly and prorated daily from the time any obligation under this Agreement to which such interest rate relates arises.

"Lender" means the entity or entities, if any, providing or that may provide financing to Owner in respect of the Work or any portion thereof.

"Lender's Engineer" means the entity designated in writing by Lender as its engineering consultant in respect of the Work.

"Mechanical Completion" means, with respect to any Unit, that (i) Contractor has completed the Work (other than warranty work under Section 10 and work associated with the Output Demonstration Test, the Performance Tests and the satisfaction of the Performance Guarantees) with respect to such Unit, except for Punch List Items (and such completion is supported by a certificate from Contractor), (ii) all civil work associated with such Unit is one hundred percent (100%) complete except for Punch List Items (and such completion is supported by a certificate from Contractor), (iii) such Unit is mechanically and electrically sound and operational, (iv) such Unit has been demonstrated to be able to perform its function (as specified in this Agreement), as verified by successful completion of commissioning activities set forth in the Project Scope Document, (v) such Unit is ready for commercial start-up and Output Demonstration Testing and Performance Testing, and (vi) Owner has designated in writing that it accepts such Unit as "mechanically complete", which acceptance will not be unreasonably withheld.

"Non-Proprietary Documents" means all Documents that are not Proprietary Documents.

"Output Demonstration Test" has the meaning specified in Section 6.1.

"Owner" means Egenor S.A..

"Performance Guarantee(s)" has the meaning specified in Section 12.4.

"Performance Test(s)" has the meaning specified in Section 6.3.

"Permitted Liens" means (i) liens, claims and other encumbrances resulting from the acts or omissions of Owner and (ii) liens, claims and other encumbrances of Subcontractors that have been adequately bonded by Contractor.

"Progress Payment" has the meaning specified in Section 7.1.2.

"Progress Payment Schedule" means the progress payment schedule that is attached hereto as part of Appendix B.

"Progress Report" has the meaning specified in Section 3.6.1.

"Project Scope Document" means the Project Scope Document contained in Appendix A hereto.

"Proprietary Documents" means the Documents that are marked "Proprietary" on the Document Delivery Schedule.

"Punchlist Items" means, with respect to any Unit, the items that are mutually agreed upon by Owner and Contractor in writing that remain to be completed with respect to such Unit, and that do not impact the operation or safety of such Unit.

"Release" means the Limited Engineering Release dated as of March 14, 1997, between Owner and Contractor.

"Retainage" has the meaning specified in Section 7.1.3.

"Schedule of Values" means the schedule of values that is attached hereto as part of Appendix B.

"Scheduled Substantial Completion Date" means, with respect to any Unit, the date specified on the Contract Milestone Schedule as the Scheduled Substantial Completion Date for such Unit.

"Sixth Unit Daily Bonus" has the meaning specified in Section 12.3.3.

"Subcontractor" means any contractor, constructor, supplier or vendor of equipment or services to Contractor or to any subcontractor thereto as contemplated in Section 3.11 hereof.

"Substantial Completion" has the meaning specified in Section 6.2.

"Substantial Completion Date" has the meaning specified in Section 6.2.5.

"Test Procedures" has the meaning specified in Section 6.1.

"Unit" means each of Unit 1, Unit 2, Unit 3, Unit 4, Unit 5 and Unit 6, as such Units are described in the Project Scope Document.

"Wet Period" means the period from and including December 1 to and including April 30.

"Work" means: (i) all work described in the Project Scope Document (including, without limitation, all work described in the Release); (ii) all work, labor, services, methods, material, equipment and other items to be performed or supplied by

Contractor pursuant to this Agreement; (iii) all labor, services, methods, material, equipment, transportation and other facilities as may be necessary to complete the other portions of the Work in accordance with the performance standards, criteria and design specifications set forth herein, or as may be necessary to conduct the Performance Tests and to satisfy the Performance Guarantees; (iv) all other labor, services, methods, materials, transportation and equipment as may be normally considered part of the type of project covered by this Agreement, whether or not fully detailed in the Documents or listed in detail in the Project Scope Document; (v) all work associated with authorized Changes under Section 8; and (vi) all warranty work described in Section 10.

3. THE WORK

3.1 General. Contractor shall perform the Work in accordance with the terms and subject to the conditions of this Agreement, including, without limitation, the Project Scope Document. Contractor began performance of the portion of the Work described in the Release on the date thereof. Contractor shall begin performance of the balance of the Work on the date hereof. Contractor shall perform all Work in compliance with the Contract Milestone Schedule.

3.2 Scope of Work in General.

3.2.1 Contractor shall perform civil, mechanical, and electrical layout and interface engineering; turbine generator and controls equipment disassembly and installation; and civil engineering, evacuation, and construction, in accordance with this Agreement, including, without limitation, the Project Scope Document.

3.2.2 Contractor shall be responsible for, and shall pay, all costs incurred in connection with the transportation to and unloading at the Facility Site of all equipment, materials and other items of Work provided under this Agreement.

3.3 Approvals; Licenses; Permits.

3.3.1 All approvals, licenses, certificates and permits required by any Governmental Authority or any other third party shall be secured and paid for: (i) by Contractor, if such approvals, licenses, certificates and permits are required for the proper execution and completion of the Work or the design, engineering, construction, and installation of any Unit; (ii) by PEABB, if such approvals, licenses, certificates, and permits are required for the procurement of equipment, commission testing of the equipment, or start-up or output demonstration testing of any Unit; or (iii) by Owner, if such approvals, licenses, certificates and permits are required for the existence and operation of the Facility. Each party shall provide the other with such assistance as such other party may request in its efforts to obtain approvals, certificates, licenses and permits pursuant to this Agreement.

3.3.2 Contractor, at its own expense, shall obtain all approvals, licenses, certificates and permits necessary for the ordinary conduct of its business as contemplated by this Agreement, including permits for hauling materials, disposal of waste (excluding Hazardous Materials unless such Hazardous Materials are brought onto the Facility Site by Contractor or Subcontractors) and transportation of materials provided under this Agreement to and from the Facility Site.

3.4 Delivery of Documents; Owner and Engineer Review

3.4.1 As soon as each Document becomes available and in accordance with the Document Delivery Schedule and Project Scope Document, Contractor shall provide to PEABB seven (7) bilingual (Spanish and English) copies of each Document.

If Contractor fails to deliver any Document by the time specified in the Document Delivery Schedule, then PEABB may withhold an amount equal to the Scheduled Value for such Document from the Progress Payment immediately following the date such Document is due and fails to be delivered to PEABB. PEABB shall pay such withheld amount to Contractor in the Progress Payment immediately following the respective date such Document is delivered to PEABB in the form required by this Agreement.

3.4.2 Contractor shall submit all Documents to PEABB for its review and comment prior to commencement of any Work with respect thereto. PEABB shall have twenty (20) Business Days after the receipt of each Document to provide their written comments thereon to Contractor. PEABB's review shall be solely for the purpose of ascertaining whether Contractor's design and engineering work is in conformity with the Project Scope Document, and PEABB may require that any Document submitted to it amended to meet the terms and conditions of this Agreement. PEABB shall have fifteen (15) business days after receipt of a Document amended in accordance with the immediately preceding sentence to review such amended Document. Such review shall be limited only to the portions of such Document that were amended.

Contractor may continue Work during PEABB's review period; however, if PEABB's review finds that Contractor's design and engineering work is not in conformance with the Project Scope Document, Contractor shall promptly correct the nonconforming design and engineering work. Review and comment by PEABB shall not relieve Contractor of any of its responsibilities hereunder nor shall such review and comment be construed as an endorsement by PEABB of the design and engineering of any Unit or any other part of the Work or any warranty by PEABB of the safety, durability, reliability or suitability of any Unit or any other part of the Work.

3.5 Monitoring and Inspection

3.5.1 PEABB,Owner, Engineer and their duly authorized agents, representatives and employees may monitor and inspect the Work in accordance with this Section 3.5.1.

PEABB, Owner and Engineer may monitor and inspect the portion of the Work conducted at the Facility Site at any time and from time to time, without adhering to an inspection plan with witness points. In connection with the monitoring and inspection of Work conducted at the Facility Site, PEABB, Owner, or Engineer may, at any time, and from time to time, direct Contractor to dismantle or uncover any part of the Work. Upon receipt of such direction, Contractor shall, promptly and at its sole expense, dismantle or uncover such part of the Work. If it is necessary to dismantle or uncover any part of the Work for an inspection, and no defect or non-conformity is discovered, PEABB shall reimburse Contractor for the cost of dismantling or uncovering and reassembling and recovering the Work for which PEABB is reimbursed for by Owner, and shall grant Contractor an extension in the Contract Milestone Schedule equal to the number of days that PEABB is granted by Owner for the time Contractor spent uncovering, dismantling, reassembling and recovering such portion of the Work.

Neither monitoring nor inspection of the Work by PEABB, Owner or Engineer shall relieve Contractor of any of its responsibilities hereunder. In addition,

neither monitoring nor inspection of the Work by PEABB, Owner or Engineer shall be construed as an endorsement by PEABB, Owner or Engineer of the design or engineering of any Unit or any other part of the Work or a warranty by PEABB, Owner or Engineer of the safety, durability, reliability or suitability of any Unit or any other part of the Work.

3.5.2 Prior to Final Completion, PEABB shall have the right to require Contractor to correct any portion of the Work that does not conform to the terms and conditions of this Agreement. If PEABB discovers that any Work is defective or nonconforming, PEABB shall give Contractor written notice specifying such defect or nonconformity, and Contractor shall, at its sole expense, take prompt corrective action with respect thereto; provided, however, that Contractor shall not be obligated to correct any defect or nonconformity to the extent that such defect or nonconformity is not caused by Contractor, Subcontractor or any employee, agent or representative of Contractor or its Subcontractors. Neither PEABB's identification of nonconforming Work pursuant to this Section 3.5.2 nor PEABB's failure to identify nonconforming Work prior to Final Completion shall relieve Contractor of any of its responsibilities hereunder including, without limitation, its obligations under Section 10.

3.6 Construction Administration; Reports and Records; Meetings.

3.6.1 Contractor shall submit to PEABB by the fifth (5th) day of each month a written report in form and substance reasonably satisfactory to PEABB (such report, a "Progress Report"). Such Progress Report shall include, at a minimum: (i) a description of the progress of the Work; (ii) the status of the supply of goods, materials and equipment necessary for the completion of the Work; (iii) the status of applications for or other action taken to obtain approvals, licenses, certificates and permits required to be obtained by Contractor pursuant to Section 3.3; (iv) a comparison of the actual schedule of the Work with the Contract Milestone Schedule; (v) an evaluation of problems and deficiencies in the performance of the Work and a description of planned corrective action with respect thereto; and (vi) work planned for the following month.

3.6.2 Contractor shall keep books and accounts in accordance with generally accepted accounting principles as may be necessary for proper financial management of the Work. In any case where an adjustment to the Contract Price is to be determined on a time and materials or cost plus basis, Contractor, upon five (5) Business Days notice from PEABB, shall make its itemized books and records relating to the Agreement, with appropriate supporting documentation, available for review by PEABB and/or Owner, at Contractor's office in Lima, Peru. PEABB and/or Owner shall conduct any review of such books and records at PEABB's and/or Owner's sole cost and expense, and such review shall allow PEABB and/or Owner reasonable access to such books and records as may be necessary for PEABB and/or Owner to determine Contractor's entitlement to payment and the appropriate amount thereof. In connection therewith, PEABB's and/or Owner's review of Contractor's books and records shall be limited solely to Contractor's time and materials or cost plus charges for the purpose of verifying the accuracy and completeness of (i) direct charges, (ii) expenses, (iii) disbursements that have been invoiced to PEABB and (iv) manhours that have been invoiced to PEABB. If Work is to be performed on a time and materials or cost plus basis pursuant to this Agreement, Contractor shall submit daily time sheets (at the Facility Site level only) to PEABB on the Business Day immediately following the day on which the Work was performed.

PEABB and Owner's review rights under this Section 3.6.2 shall not entitle PEABB or Owner to review or audit the composition or reasonableness of the Contract

Price, any lump sum amounts agreed to in accordance with Section 8.1 or the mark-up percentage specified in this Agreement with respect to performance of Work on a cost plus basis. PEABB and Owner's review rights under this Section 3.6.2 shall expire one (1) year after the later of (i) Final Completion or (ii) the date on which all claims submitted before the first anniversary of Final Completion are settled.

3.6.3 Contractor shall hold progress meetings at a mutually agreed location with the PEABB and other designated parties to review the progress of the Work and to discuss any open problems or concerns affecting the Work. These meetings will be held at least monthly and at such other times as PEABB may reasonably request. The regular monthly meeting will be held sufficiently early to allow PEABB to review the Progress Report, any Application for Progress Payment and actual progress prior to approval of the Application for Progress Payment.

3.7 Ownership of Documents.

3.7.1 Each Non-Proprietary Document that is exclusively developed for this Agreement shall be the exclusive property of Owner as and when each Document is completed. Owner shall own, to the extent Contractor owns or acquires ownership of, all copyrights in and shall be entitled to use, reproduce and distribute each such exclusively developed Non-Proprietary Document without restriction.

3.7.2 Owner shall not acquire any patent, copyright or trade secret rights in any Proprietary Document or any of Contractor's proprietary processes as a result of this Agreement, except pursuant to licenses and other approvals provided in the performance of the Work and except to the extent that a non-exclusive license of such Proprietary Documents and of any of Contractor's patent, copyright or trade secret rights is required to perform any part of the Work or for Owner to operate, maintain or repair any part of the Work. Contractor hereby expressly grants to Owner a non-exclusive license to use the licenses and other approvals provided in the performance of the Work and the Proprietary Documents and Contractor's patent, copyright or trade secret rights that are required to perform any part of the Work (including, without limitation, performance of the Work by Owner pursuant to Section 11.4 or by Owner or a third party after termination of this Agreement pursuant to Section 11.1) or for Owner to operate, maintain or repair any part of the Work.

3.8 Certification of Documents. The submission by Contractor to PEABB or Owner of any Document shall constitute a certification by Contractor that the information set forth therein is accurate in all material respects. Review by PEABB, Owner or Engineer of any Document shall not constitute acceptance or approval thereof, and shall not relieve Contractor of its responsibility to fully comply with the terms and conditions of this Agreement. All civil structural drawings included in the Documents must be certified by a professional engineer or equivalent certified in Peru.

3.9 Performance Standards. Contractor's performance of the Work shall at all times conform with the standards set forth in this Agreement and be in accordance with good engineering practice and industry codes and standards.

3.10 Employees. Contractor shall at all times enforce good order among its employees and those of its Subcontractors, and shall not employ or permit any Subcontractor to employ any person not skilled in the work assigned to such person in connection with Contractor's or any Subcontractor's performance under this Agreement. PEABB and Owner shall have the right to approve Contractor's project manager for the Work, which approval shall not be unreasonably withheld. PEABB and Owner shall

have the right to require the removal of any of Contractor's or Subcontractors supervisory employees if, in the reasonable judgment of PEABB or Owner, such removal is in PEABB's or Owner's best interest, and PEABB or Owner requests such removal in writing. Contractor shall use all reasonable efforts in the employment of labor (whether directly or indirectly employed) so as to cause no conflict or interference with or between the various trades, or delay in performance of any of Contractor's obligations hereunder.

3.11 Subcontracts. Contractor agrees that it shall be as fully responsible to PEABB and Owner for the acts and omissions of its Subcontractors and of persons either directly or indirectly employed by them as it is for the acts and omissions of persons directly employed by Contractor. Nothing contained herein shall create any contractual relationship between any Subcontractor and PEABB or Owner. PEABB or Owner shall have no obligation to pay or to see to the payment of any monies to any Subcontractor. It is understood that PEABB and Owner shall have the right to approve major Subcontractors in accordance with Section 1.7 of the Project Scope Document prior to their employment by Contractor; provided, however, that such approval (i) shall not be unreasonably withheld by PEABB or Owner and (ii) shall not relieve Contractor of any of its responsibilities hereunder.

3.12 Passage of Title and Risk of Loss. Title to each Non-Proprietary Document shall pass to Owner when such Document is completed. Except for imported equipment and materials, title to all items of Work, materials and equipment covered by this Agreement shall pass to Owner upon delivery to the Facility Site of such item of Work, materials or equipment or upon delivery to Contractor's off-site storage location and after payment to Contractor of the amount due for such item of Work, materials or equipment. Title to imported equipment and materials shall pass to Owner at the port of entry into Peru. Risk of loss with respect to any Non-Proprietary Document, item of Work, materials or equipment (including, without limitation, imported materials and equipment) shall remain with Contractor, and shall not pass to Owner, until delivery to the Facility Site of such Document, item of Work, materials or equipment.

3.13 Warranty of Title. Contractor warrants title to all Non-Proprietary Documents and title to all items of Work, materials and equipment, free and clear of all liens, claims, security interests or other encumbrances, except for Permitted Liens and licenses granted under Section 3.7.2. Contractor shall indemnify, hold harmless and defend PEABB and Owner against any claims of third parties to or arising out of title to such Documents, items of Work, materials or equipment.

3.14 Taxes and Fees.

3.14.1 Except as set forth in Section 3.14.2, Owner shall be responsible for, and shall pay, value added taxes on Contractor's invoices to Owner, sales taxes, personal property taxes, use taxes and other taxes incurred in connection with the performance of the Work.

3.14.2 Contractor shall be responsible for, and shall pay, all taxes calculated on Contractor's (or its Subcontractor's or any Contractors's or Subcontractor's employees or agent's) net income, net profits, gross income or receipts, payroll taxes and any other taxes (including, without limitation, Peruvian income taxes and withholding taxes) assessed against Contractor or its Subcontractors and any employee or agent of Contractor or its Subcontractors in connection with the performance of the Work. Contractor shall indemnify, hold harmless and defend PEABB and Owner against any claims arising out of any such taxes.

3.14.3 Each party shall cooperate with the other party and provide all assistance reasonably requested by the other party to minimize the tax exposure of such other party under this Agreement in respect of taxes that may be directly assessed and borne by a party pursuant to this Agreement or that may be assessed against the one party and borne by the other pursuant to this Agreement.

3.15 Compliance with the Laws

3.15.1 Contractor shall comply with all laws, rules, regulations and ordinances of any Governmental Authority of Peru and all engineering and other industry codes and standards applicable to the performance of the Work or the Facility.

3.16 Safety. Contractor shall have sole responsibility for implementing a safety program with respect to the performance of the Work on the Facility Site, which program shall be consistent with good practices in the construction industry.

3.17 No Liens. To the extent Contractor has been paid in accordance with the terms of this Agreement, Contractor waives, and shall use its reasonable commercial efforts to cause its Subcontractors to waive, any and all liens and claims, and the right to file and enforce or otherwise assert any such liens or claims, against PEABB, Owner, the Facility, the Facility Site, or any of Owner's other property, real and personal, for work done, services performed or materials or equipment furnished in connection with the Work. To the extent Contractor has been paid in accordance with the terms of this Agreement, Contractor shall pay or discharge (by bond or other method reasonably acceptable to PEABB and Owner) immediately and of record any such lien or encumbrance filed by Contractor or any Subcontractor for labor, materials, supplies or other charges, other than Permitted Liens, which, if unpaid, might be or become a lien against PEABB or upon the Facility Site, the Facility, any of Owner's other property or any component thereof. Upon knowledge thereof, Contractor shall immediately notify PEABB of the assertion of any lien or encumbrance upon the Facility Site, the Facility, Owner's other property or any part thereof. Upon the failure of Contractor promptly to pay or discharge any lien or encumbrance as required hereby, PEABB may pay or discharge such lien or encumbrance. If Contractor was required to waive such lien or encumbrance under this Section 3.17, Contractor shall be liable to PEABB for all amounts paid and expenses incurred by PEABB in connection with such payment or discharge and PEABB may deduct such amounts and expenses from amounts otherwise due and payable by PEABB to Contractor.

3.18 Timely Performance. Time is of the essence in the performance of the parties' obligations under this Agreement with respect to the Contract Milestone Schedule and any other portion of this Agreement to which a liquidated damage is tied.

3.19 Startup and Commissioning Services. Until Substantial Completion with respect to a Unit, Contractor shall perform start-up and commissioning services for such Unit as described in Section 7.10 of the Project Scope Document, and PEABB shall provide qualified operations and maintenance personnel to assist Contractor in the performance of such start-up and commissioning services. Contractor shall provide its recommendations for operations support in terms of number, qualifications and timing of operation and maintenance personnel requirements. PEABB´s liability herunder for the acts or omissions of such operations and maintenance personnel shall be reduced to the extent such personnel are acting in good faith under the direction of the Contractor.

3.20 Contract Milestone Schedule. Contractor shall perform the Work according to the schedule attached hereto as Appendix C (the "Contract Milestone Schedule"), as such schedule may be revised from time to time with PEABB's prior written approval. The Contract Milestone Schedule shall be updated at least monthly to reflect the actual progress of the Work to date and to forecast the schedule for completion of the Work. Contractor shall include a comparison of the actual schedule of Work with the Contract Milestone Schedule in each Progress Report; provided, however, that such comparison shall not be deemed a revision to the Contract Milestone Schedule unless such comparison is approved by PEABB in writing as a revision.

3.21 Construction Plan. The Contractor shall prepare a written construction plan (the "Construction Plan") for review and reasonable approval by the PEABB. The Construction Plan shall be submitted and approved prior to commencement of site work on the Facility Site. The Construction Plan shall describe the construction involved in the performance of the Work, construction working hours, construction access and laydown areas and associated activities. Contractor shall develop the Construction Plan for the purpose of coordinating the Contractor's construction activities with the Facility's on-going operations to avoid, to the extent possible, unreasonable interference with the Facility's on-going operations and the work of other subcontractors or vendors on the Facility Site while permitting performance of the Work to progress in an orderly and timely fashion.

3.22 Owner's Obligations. Owner shall furnish to Contractor all items described in Section 1.8 of the Project Scope Document as PEABB's Responsibilities. PEABB shall furnish such items to Contractor at PEABB's expense and at such times, locations and in such quantities as are reasonably required by Contractor for the performance of the Work.

4. FACILITY SITE

4.1 Rights in Facility Site. Owner has granted PEABB and PEABB hereby grants to Contractor a license to enter upon and to use the Facility Site for the purpose of performing the Work in accordance with the provisions of this Agreement. Contractor shall occupy and use the Facility Site solely for the purpose of performing the Work in accordance with the provisions of this Agreement. Contractor shall not occupy or use any part of the Facility Site for any purpose, operation or use which is not necessary or incidental to the purposes set forth in this Agreement.

4.2 Contractor Investigation and Site Acceptance. Contractor acknowledges that Owner has furnished PEABB with site drawings relating to the Facility Site which have been provided to Contractor, and that, in addition to reviewing such site drawings, Contractor has visited the Facility Site to generally familiarize itself with the site and the local conditions. As a result of the foregoing, Contractor has fully satisfied itself as to: (i) the nature and location of the Facility Site and the suitability of the Facility Site for the performance by Contractor and its Subcontractors of the Work,(ii) the character of equipment and facilities needed prior to and during construction, start-up and output demonstration testing of each Unit, and (iii) the general and local conditions and all other matters relating to the Facility Site which can in any way affect the performance of Contractor under this Agreement; provided, that, in connection with the foregoing, Contractor shall be responsible only for items or conditions that Contractor could determine or see, or should reasonably have determined or seen, from a thorough inspection of the Facility Site while in operation. Contractor shall promptly notify PEABB of (x) any previously unknown physical conditions at the Facility Site of an unusual nature, not revealed by previous investigations or previously disclosed to it and

differing from those reasonably expected to be encountered in work of the character provided for in this Agreement in the vicinity of the Facility Site, and (y) the presence of any Hazardous Material not revealed by previous investigations or previously disclosed to it.

4.3 Security of Site. Owner shall be responsible for the security and protection of the Facility Site, the Facility and all equipment and materials located thereon or incorporated therein. Contractor shall be responsible for the security of any materials or equipment for the Facility that are stored by Contractor at a site other than the Facility Site.

4.4 Cleanup. Contractor at all times shall keep the Facility Site free from accumulation of excess waste materials or rubbish caused by or resulting from its performance of the Work. Upon Final Completion, Contractor shall remove from the Facility Site all of its waste materials, tools, equipment, machinery and surplus materials not constituting part of the Facility other than materials, tools, equipment and machinery supplied by PEABB or Owner including, but not limited to, those supplied pursuant to Section 5.2. Contractor shall be fully responsible for site restoration in accordance with Section 1 of the Project Scope Document.

5. UTILITIES AND SERVICES

5.1 Provision of Service. PEABB and/or Owner shall maintain, at PEABB's and/or Owner's own expense, facilities and services, and shall pay all utility usage charges, required for the performance of the Work and the operation of the Facility as more particularly defined in Section 1.8 of the Project Scope Document; provided, that, in providing such utilities, facilities and services, PEABB and/or Owner shall not be obligated to install or construct any new facility or to take any action that could reasonably be expected to have an adverse effect on operations of the Facility.

6. SUBSTANTIAL COMPLETION; ACCESS TO UNITS; FINAL COMPLETION

6.1 Substantial Completion. "Substantial Completion" shall be deemed to have occurred with respect to a Unit upon the satisfaction of the following conditions with respect to such Unit:

6.1.1 Mechanical Completion shall have been reached with respect to such Unit;

6.1.2 Output Demonstration Testing shall have been completed with respect to such Unit, and such Unit shall have passed an Output Demonstration Test, and Owner shall have accepted such test and such Unit's performance thereunder in writing dated as of the date of such test (whether or not delivered on such date);

6.1.3 Contractor shall have delivered to Owner all Documents required to be delivered to Owner pursuant to Sections 3.4.1 and 7.1.4;

6.1.4 Contractor shall have delivered to PEABB a notice signed by the Contractor certifying that all of the preceding conditions in this Section 6.1 have been satisfied, and PEABB shall have accepted such certification in writing; and

6.1.5 Owner shall have delivered to PEABB a certificate stating that all of the preceding conditions in this Section 6.1 have been satisfied, or specifying the items that have not been satisfied. Owner shall deliver such certificate to PEABB within five (5) Business Days of the satisfaction of Contractor's delivery of the certificate referenced in

Section 6.2.5. If Owner fails to deliver such certificate within the time period set forth in the immediately preceding sentence, the condition set forth in this Section 6.1.5 shall be deemed satisfied.

Upon the satisfaction of the conditions set forth in Sections 6.1.1 through and including 6.1.5 with respect to a Unit, and receipt of a certificate from Owner stating that all such conditions have been satisfied: (i) PEABB shall conditionally accept such Unit, subject to Contractor's obligation to achieve Final Completion in accordance with Section 6.5, by delivering to Contractor written notice of such conditional acceptance within five (5) Business Days of the satisfaction of the conditions set forth in Sections 6.1.1 through and including 6.1.6; and (ii) Contractor shall turn over control and operation of such Unit to PEABB. The earliest date on which all the conditions specified in Sections 6.1.1 through and including 6.1.5 are satisfied, and Owner shall have delivered a certificate stating that all such conditions have been satisfied, with respect to a Unit shall be the "Substantial Completion Date" for such Unit.

6.2 Access to Units between Substantial Completion and Final Completion. PEABB shall provide reasonable access to a Unit to Contractor between the Substantial Completion Date with respect to such Unit and the Final Completion Date to allow Contractor to address all Punchlist Items with respect to such Unit.

6.3 Final Completion. "Final Completion" shall be deemed to have occurred with respect to the Work upon the satisfaction of all the following conditions with respect to the Work:

6.3.1 All the conditions for Substantial Completion shall have been satisfied with respect to all Units, or shall be satisfied simultaneously with Final Completion;

6.3.2 The performance of the Work (other than warranty work) with respect to all Units shall be one hundred percent (100%) complete, including, without limitation, the addressing of all Punchlist Items to Owner's reasonable satisfaction (and such completion shall be supported by a certificate from Contractor);

6.3.3 Contractor shall have delivered to PEABB all Documents required to be delivered to PEABB/Owner pursuant to Section 7.1.5;

6.3.4 There shall exist no Event of Default, or an event which, with the giving of notice or lapse of the cure period specified in Section 11.1 with respect to such event, would constitute an Event of Default; and

6.3.5 Owner shall have delivered to PEABB a certificate stating that all of the preceding conditions in this Section 6.3 have been satisfied, or specifying the items that have not been satisfied.

Upon the satisfaction of all of the conditions set forth in Sections 6.3.1 through and including 6.3.4 and receipt of a certificate from Owner stating that all such conditions have been satisfied, PEABB shall accept the Work for all purposes of this Agreement and shall deliver written notice of its final acceptance to Contractor. The date on which all of the conditions set forth in Sections 6.3.1 through and including 6.3.4 are satisfied, and Owner shall have delivered a certificate stating that all such conditions have been satisfied, shall be the "Final Completion Date".

6.4 Revenues Prior to Final Completion. All revenues (if any) derived from the operation of a Unit prior to the Final Completion Date shall be the sole property of Owner.

7. PAYMENT

7.1 Contract Price; Payment Terms. In consideration of Contractor's performance of the Work under this Agreement, PEABB shall pay to Contractor the firm, fixed price of Three million nine hundred nine thousand six hundred ten dollars (U.S.$3,909,610) (the "Contract Price"). Except as provided in Section 8 and Section 3.14.1, the Contract Price is the entire compensation due Contractor for performance of all of the Work described in this Agreement including, but not limited to, Changes and the performance of any warranty obligations under this Agreement. Contractor shall be fully responsible for any costs associated with performance of the Work, Changes (except as set forth in Section 8) and warranty obligations under this Agreement. The Contract Price shall be paid in accordance with Appendix B as follows:

7.1.1. On or before the tenth (10th) day after Contractor has satisfied its obligations under Section 9.4, PEABB shall pay Contractor the first Progress Payment as set forth in the Progress Payment Schedule.

7.1.2 On or before the first day of each month following the date of this Agreement, Contractor shall prepare and submit a written application (an "Application for Progress Payment") for the progress payment payable upon completion of stages of the Work completed during the preceding month as set forth in Appendix B hereto (a "Progress Payment"). Each Application for Progress Payment shall be certified by an authorized employee of Contractor and shall contain a detailed itemized description of the Work performed during such month.

7.1.3 Appendix B of this Agreement is the Progress Payment Schedule and the Schedule of Values that establishes the portion of the Contract Price that will be due and payable each month.

Unless PEABB indicates in writing to Contractor its reasons for refusing to approve any Progress Payment, PEABB shall pay Contractor as specified in this Section 7.1.3 within thirty (30) days after receipt of an Application for Progress Payment; provided, that PEABB shall not have any obligation under this Section 7.1.3 unless and until Contractor has satisfied its obligations under Section 9.4. In the case in which Contractor submits Application(s) for Progress Payments before it has satisfied its obligations under Section 9.4, unless PEABB indicates in writing to Contractor its reasons for refusing to approve any Progress Payment, PEABB shall pay Contractor as specified in this Section 7.1.3 with respect to such submitted Application(s) for Progress Payments within thirty (30) days of the date on which Contractor satisfies its obligations under Section 9.4. Except as specified in the next sentence of this paragraph, PEABB shall pay to Contractor the lesser of (i) the earned value of the Work, as determined by the Schedule of Values, for such month and (ii) the maximum value as determined in the Progress Payment Schedule for such month. In cases in which Contractor has performed any activity of the Work (or any part of such activity) scheduled in the Schedule of Values as Work to be performed in a month later than the month in which Contractor submits its Application for Progress Payment, PEABB shall pay to Contractor the earned value of the activities of the Work, as determined by the Schedule of Values, performed through the date of such Application for Progress Payment; provided, that in no event shall PEABB pay Contractor for the earned value of

the activities of the Work, as determined by the Schedule of Values, more than two (2) months before such Work is scheduled to be performed under the Schedule of Values.

Ten percent (10%) (the "Retainage") of the amount that PEABB is obligated to pay in accordance with the immediately preceding paragraph shall be withheld from each Progress Payment. No Progress Payments made by PEABB to Contractor shall be considered evidence of satisfactory performance of the Work by Contractor, in whole or in part, nor shall payment of such Progress Payments relieve Contractor of its obligation to perform the Work in strict compliance with the terms of this Agreement.

PEABB shall have the right to request additional supporting documentation or further explanation of, and to dispute, any matter set forth in any Application for Progress Payment. PEABB's payment of any Progress Payment shall not be deemed a waiver of such rights or any other rights or remedies of PEABB under this Agreement. If PEABB shall dispute the Application for Progress Payment, PEABB shall pay the amount of the Progress Payment that is not in dispute less the applicable Holdback Amount. If Contractor shall submit a revised Application for Progress Payment in response to PEABB's refusal to approve an original Application for Progress Payment, the procedures of this Section 7.1.3 shall be applicable to such revised Application for Progress Payment. Any disputed payment claimed by Contractor and later determined to be due to Contractor shall be deemed delinquent thirty (30) days after PEABB's receipt of the original Application for Progress Payment and shall bear interest from the delinquent date until paid at the Interest Rate. If PEABB determines that any Progress Payment shall have been overpaid, Contractor shall promptly refund the amount of the excess payment together with interest thereon at the Interest Rate from the day following the date of such Progress Payment until the date of such refund.

7.1.4 Within thirty (30) days following the Substantial Completion Date with respect to a Unit, PEABB shall pay Contractor the unpaid balance of the Contract Price allocable to such Unit minus the sum (such sum, the "Final Completion Holdback") of: (a) the estimated cost of completing the Punchlist Items with respect to such Unit; plus (b) an amount that, when aggregated with all Retainage previously retained by PEABB, will equal, the following portion of such allocated Contract Price (i) with respect to the first two Units to reach Substantial Completion, eight percent (8%), (ii) with respect to the third and fourth Units to reach Substantial Completion, six percent (6%) and (iii) with respect to the last two Units to reach Substantial Completion, five percent (5%).

PEABB shall not be obligated to make any payment under this Section 7.1.4 unless Contractor shall have submitted the following information to Owner:

7.1.4.1 an affidavit that all payrolls, invoices of direct Subcontractors, invoices of indirect Subcontractors (to Contractor's best knowledge), invoices for materials and equipment and other indebtedness connected with or arising out of Work, for which a claim against PEABB, the Owner, the Facility, the Facility Site or Owner's other property may in any way be made or asserted, other than Permitted Liens, have been paid or otherwise satisfied or provided for by a bond or other instrument mutually acceptable to PEABB, Owner and Lender; and

7.1.4.2 an affidavit that Contractor has paid or discharged its obligations hereunder or to third parties in connection with the performance or completion of the Work, including releases and waivers of liens (other than Permitted Liens) which are in the possession of Contractor in order to establish such payment or discharge; provided, however, that if Contractor is unable to provide an affidavit that a lien has been discharged, Contractor shall furnish a bond or other instrument acceptable to PEABB,

Owner and Lender to indemnify PEABB, Owner and Lender against any such lien; and provided further, that if any such lien remains unsatisfied after the Substantial Completion Date, at PEABB's option, Contractor shall promptly refund to PEABB all amounts that PEABB may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees, or PEABB may add such amounts to the Final Completion Holdback.

7.1.5 Within thirty (30) days after the Final Completion Date, Owner shall pay Contractor the balance of the Contract Price previously unpaid; provided that Contractor shall have submitted the following information to Owner:

7.1.5.1 an affidavit that all payrolls, invoices of direct Subcontractors, invoices of indirect Subcontractors, invoices for materials and equipment and other indebtedness (other than the Facility Construction Financing) connected with the Work for which a claim against PEABB, Owner, the Facility or the Facility Site may in any way be made or asserted, other than Permitted Liens, have been paid or otherwise satisfied or provided for by a bond or other instrument satisfactory to PEABB, Owner and Lender;

7.1.5.2 such receipts, releases and waivers of liens, other than Permitted Liens, in such form and from such persons as may reasonably be requested by PEABB in order to establish the payment or discharge by Contractor of its obligations hereunder or to third parties in connection with the performance and completion of the Work; provided, however, that if any such person shall refuse to furnish a receipt, release or waiver required by PEABB, Contractor shall furnish a bond or other instrument mutually acceptable to PEABB, Owner and Lender to indemnify PEABB, Owner and Lender against any such lien; and provided, further, that if any such lien remains unsatisfied after all payments to Contractor are made, Contractor shall promptly refund to PEABB all amounts that PEABB may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

7.2 PEABB's Right to Withhold Payments. Notwithstanding the foregoing provisions of this Section 7, if any Event of Default by Contractor shall have occurred and be continuing, any amount payable to or for the account of Contractor shall be retained by PEABB as security for the performance of the obligations of Contractor under this Agreement to the extent of the actual or anticipated damages incurred or expected to result from such Event of Default; provided, however, that PEABB shall not be entitled to withhold payments during the period in which Contractor is diligently pursuing cure of an Event of Default. At such time thereafter as no Event of Default shall be continuing or the period of time or giving of notice has lapsed with respect to such Event of Default, such amount shall be paid promptly to Contractor unless this Agreement shall have been terminated pursuant to Section 11. In addition, if any third party (including, without limitation, any Subcontractor) asserts a claim or lien against PEABB, Owner, the Facility, the Facility Site or any other property of Owner, which claim or lien is chargeable or specifically related to Contractor's or any Subcontractor's performance of the Work hereunder, and Contractor fails to discharge such lien in accordance with Section 3.17, PEABB shall have the right to retain out of any payments due or to become due to Contractor, an amount sufficient to fully protect PEABB from all claims, losses, damages and expenses related to such claim or lien until the claim has been terminated or released or the lien has been removed to PEABB's reasonable satisfaction. PEABB's right to withhold monies pursuant to this Section 7.2 is in addition to any other rights and remedies available to PEABB under this Agreement.

7.3 Contractor's Right to Dispute Payments. Contractor shall have the right to dispute any amount PEABB claims as due and payable from Contractor to PEABB pursuant to this Agreement. In the event of such a dispute, Contractor shall pay the amount that is not in dispute. Any disputed amount claimed by PEABB and later determined to be due to PEABB shall be deemed delinquent thirty (30) days after Contractor's receipt of PEABB's request for payment and shall bear interest from the delinquent date until paid at the Interest Rate.

8. CHANGE ORDERS

8.1 PEABB Requested Changes. At any time, and from time to time, PEABB may order Changes. If PEABB wishes to make a Change, PEABB shall submit a written proposal to Contractor describing such Change. Contractor shall promptly review PEABB's proposal and prepare and present to PEABB, within five (5) Business Days of receipt of PEABB's proposal, a written order (a "Change Order") which shall describe the Change and the effect, if any, such Change will have, in Contractor's judgment, on the Contract Price, the Contract Milestone Schedule, the Progress Payment Schedule, the Scheduled Substantial Completion Date for any Unit to which such Change relates and the Performance Guarantees. If PEABB wishes to proceed with such Change, it shall: (i)in cases in which PEABB agrees with the Change Order, approve the Change Order by executing it; or (ii) in cases in which PEABB does not agree with the Change Order, provide written direction to Contractor to proceed with such Change. Upon receipt of an executed Change Order or PEABB's written direction, as applicable, in accordance with the immediately preceding sentence, Contractor shall commence work with respect to the Change.

8.2 Contractor Requested Changes. Contractor may provide PEABB with written notice of any condition or event that Contractor believes is a Change that will require modification in, or change to, any potion of the Work, the Contract Price, the Contract Milestone Schedule, the Progress Payment Schedule, the Scheduled Substantial Completion Date for any Unit to which such Change relates and the Performance Guarantees. Contractor shall deliver such notice immediately on the date on which the condition or event constituting such Change initially occurs, and such notice shall describe the event or condition on which such Change is based and any equitable adjustment that Contractor seeks in respect of such Change relating to the Contract Price, the Contract Milestone Schedule, the Progress Payment Schedule, the Scheduled Substantial Completion Date for any Unit to which such Change relates or the Performance Guarantees. Within ten (10) Business Days of PEABB's receipt of such notice, PEABB shall deliver to Contractor written notice of PEABB's determination as to whether the noticed condition or event constitutes a Change. If PEABB determines that such condition or event constitutes a Change, PEABB shall issue a Change Order authorizing such Change. If PEABB determines that such condition or event does not constitute a Change, PEABB shall specify its reasons for denying the Change request. Contractor shall not be excused from performance under this Agreement if PEABB does not authorize a Change under this Section 8.2; provided, that nothing contained in this Section 8.2 shall limit Contractor's rights under Section 13.

8.3 Adjustments Due to Changes; Payment for Changes. It is anticipated and intended by the parties that increases or decreases in Contract Price resulting from a Change authorized by PEABB under Section 8.1 or 8.2 shall be determined by means of a mutually acceptable lump sum. If the parties cannot agree on what adjustment should be made in the Contract Price, the Contract Milestone Schedule, the Progress Payment Schedule, the Scheduled Substantial Completion Date, the Performance Guarantees or other aspects of the Work as a result of a Change, Contractor shall

proceed to execute the work ordered in the Change Order in accordance with Section 8.2 promptly upon receipt of written directions to do so from PEABB, pending resolution of such disagreement pursuant to Section 13. In a case in which PEABB directs Contractor to proceed and no agreement has been reached with respect to a lump sum amount for such Change, PEABB shall reimburse Contractor for all Work associated with such Change on a direct cost plus ten percent (10%) basis.

8.4 Books and Records. With respect to all costs for which Contractor is or may be entitled to compensation on a cost plus basis, Contractor shall maintain complete and accurate records and supporting documentation in accordance with Section 3.6.2.

9. INDEMNITIES; INSURANCE; GUARANTY

9.1 Indemnities.

9.1.1 Contractor shall indemnify, defend, and hold harmless PEABB, Owner, their respective officers, directors, partners, employees and agents from and against all damages, losses, expenses, claims or liabilities (including, but not limited to attorneys' fees) incurred by or asserted against PEABB, Owner, their respective officers, directors, partners, employees or agents for injury to or death of persons, including Contractor's employees, and for physical loss of or physical damage to tangible property, real or personal, only to the extent the same is connected with or results from the acts or omissions of Contractor, Subcontractors and any officer, director, partner, employee or agent of Contractor or Subcontractors during the performance of the Work.

9.1.2 Contractor shall indemnify, defend, and hold harmless PEABB, Owner, their respective officers, directors, partners, employees and agents from and against all damages, losses, expenses, claims or liabilities incurred by or asserted against PEABB, Owner, their respective officers, directors, partners, employees or agents for violation or infringement of any patent, copyright, trademark, trade secret or other rights of any person in any design, equipment, or process incorporated into the Work by Contractor. In the event of any such damage claim, loss, cost, expense, suit or liability, Contractor shall have the right, at Contractor's sole expense, to take the following action in the following order of precedence: (i) procure for PEABB and Owner the right to continue using such design, equipment or process; (ii) modify the Work in a way satisfactory to PEABB and Owner so that it becomes noninfringing; (iii) replace the infringing part of the Work with substantially equivalent non-infringing work provided that such replacement is reasonably acceptable to PEABB and Owner; or (iv) refund to PEABB the portion of the Contract Price allocable to such infringing part of the Work. Contractor shall have no liability under this subsection for any design, equipment or process mandated in writing by PEABB.

9.1.4 Contractor shall use its commercially reasonable efforts to obtain from each of its Subcontractors indemnities running to PEABB and Owner similar to those set out in Sections 9.1.1 and 9.1.2.

9.1.5 Contractor's obligations of indemnity under the provisions of this Section 9.1 are subject to the conditions that: (a) the indemnified party gives prompt notice to Contractor of any such claim or suit and furnish reasonable assistance in connection with the defense of any such claim or suit; provided, that failure to give notice shall not relieve the Contractor of its obligation to indemnify hereunder unless, and then only to the extent that, the Contractor is materially prejudiced by such failure; (b) the Contractor will control the defense of such claim or suit unless there is a conflict between indemnified party's and Contractor's interest in the defense of such suit (in such case,

indemnified party may maintain a separate defense of such suit at Contractor's expense) and (c) the indemnified party shall settle any such claim or suit without the prior approval of the Contractor unless such settlement fully releases the Contractor.

9.1.6 The indemnities provided for in this Section 9.1 shall survive termination or expiration of this Agreement and Final Completion.

9.2 Owner Provided Insurance. Owner shall maintain or cause to be maintained in full force and effect during performance of the Work at the Facility Site "All Risk" Contractor's Installation Risk Insurance covering the Facility, and materials and equipment to be incorporated therein while in transit, off-site storage or at the Facility Site. Such policy will provide physical loss or damage coverage for the Facility, including coverage for the fees and charges of architects and engineers, in an amount equal to the replacement cost of the Facility and with deductibles of not more than $100,000 for start-up and testing and $100,000 for loss or damage from all other insured perils. Such policy shall be endorsed to include coverage for "Delay in Completion" with a limit to be based on the Owner's loss of Facility income due to such delay and a deductible of not more than thirty (30) days of such loss. In connection with Owner's maintenance of such policy, Contractor will provide PEABB, before Owner places such policy, with a list of Contractor owned equipment to be covered on the Facility Site under such policy. In addition, Owner shall maintain or cause to be maintained in full force and effect during the performance of the Work wet marine coverage.

Contractor shall be included as an additional insured as its interests may appear with an insurer's waiver of subrogation in favor of Contractor. Such insurance shall remain in effect until Final Completion. In addition, such insurance shall include twelve (12) months of extended maintenance coverage for the benefit of PEABB, Owner, Lender, Contractor and Subcontractors.

9.3 Contractor Provided Insurance. Contractor shall maintain or cause to be maintained in full force and effect during performance of the Work the following insurance:

9.3.1 Insurance for Workers' Compensation, covering Contractor's employees as required by law and Employer's Liability Insurance with a limit of $2,000,000. Such coverage will include statutory employer coverage for the benefit of Owner, where applicable.

9.3.2 Comprehensive Bodily Injury and Property Damage Liability Insurance, covering Contractor's liability which may arise out of or result from Contractor's performance under this Agreement, whether performed by Contractor or its Subcontractors, for (a) damages due to injury to or death of any person, or injury to or destruction of property, with a $2,000,000 combined single limit for each occurrence and in aggregate and (b) damages due to injury to or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle, with a $2,000,000 combined single limit for each occurrence and in aggregate. Such insurance shall include specific coverage for contractual liability, products/completed operations liability and indemnity liability for the warranty period established under Section 10.

9.3.3 Umbrella or Excess Liability coverage for insured losses in excess of the limits under Sections 9.3.1 and 9.3.2 in the amount of Five Million Dollars ($5,000,000).

9.3.4 The insurance coverage required by Section 9.3.2 and Section 9.3.3 shall be in effect and shall respond to claims arising out of professional services rendered by Contractor in connection with, and in support of, the provision of products or services under this Agreement.

9.3.5 If Contractor fails to provide or maintain any of the insurance coverage required to be maintained by Contractor pursuant to this Section 9.3, Owner shall have the right to provide or maintain such coverage at Contractor's expense, either by direct charge or set-off.

Contractor shall cause its insurers to amend or endorse such Comprehensive Bodily Injury and Property Damage Liability Insurance and the Umbrella or Excess Liability to (i) include PEABB, Owner, Lender and their respective directors, officers and employees as additional insureds to the extent necessary to secure Contractor's indemnity obligations hereunder, excluding workers compensation, (ii) provide that such insurance, subject to and to the extent of PEABB's, Owner's and Lender's additional insured status, is primary with respect to the interest of PEABB, Owner, Lender and their respective directors, officers and employees and that any other insurance maintained by them is in excess and not contributory to the insurance provided herein, (iii) include a waiver of all rights of subrogation against PEABB, Owner, Lender and their respective directors, officers and employees, subject to and to the extent of PEABB's, Owner's and Lender's additional insured status (iv) contain a severability of interest provision, (v) provide that PEABB, Owner, Lender and their respective directors, officers or employees shall not be liable for the payment of premiums under such policies, (vi) provide that complete copies of all inspection or other reports required or performed for the insurer shall be provided to PEABB, Owner and Lender within thirty (30) days of completion of such reports, and (vii) provide for at least thirty (30) days written notice be given to PEABB, Owner and Lender prior to cancellation or material modification of the coverage described therein.

Within fourteen (14) days of the effective date of this Agreement and each renewal date for the insurance specified herein, Contractor shall furnish Owner and Lender certificate(s) of insurance as evidence that the foregoing insurance has been obtained and is being maintained by Contractor.

Before permitting any Subcontractor to perform any portion of the Work at or in connection with the Facility, Contractor shall obtain a certificate of insurance from each Subcontractor evidencing that such Subcontractor has obtained insurance in such amounts and against such risks as customarily carried by persons engaged in similar businesses in the same geographic area.

9.4 Contractor Security for Performance. As soon as possible, but in no event later than the thirtieth (30th) day after the date of this Agreement, Contractor: (i) shall provide to Owner, at Contractor's sole cost and expense (which shall not be reimbursed by an increase in the Contract Price or otherwise) a performance bond in the amount of the Contract Price for the benefit of the PEABB and ABB Inc. in the form of Exhibit A hereto.

10. WARRANTY

10.1 Warranty Terms. Contractor warrants to PEABB and Owner that: (i) all materials, equipment and labor constituting all or any portion of the Work shall be free from defects in design, materials and workmanship, and will strictly conform to the standards and specifications set forth in this Agreement; (ii) all services performed by Contractor

hereunder shall be performed in a competent manner and in accordance with the level of skill, care, judgement and expertise expected of providers of comparable services for the type of work involved; and (iii) all materials and equipment furnished under this Agreement shall be new (except as may be otherwise approved by PEABB in writing), free from defects in materials and workmanship, of the quality specified in this Agreement and shall conform to the specifications set forth in this Agreement.

10.2 Defects and Nonconformities. If at any time before the earlier of (i) the first anniversary of the Substantial Completion Date with respect to a Unit or (ii) the date that is thirty-six (36) months after delivery of the warranted item of Work to the Facility Site, Contractor, PEABB, or Owner shall discover any defect or nonconformity in the design, materials, equipment or workmanship of such Unit or any portion thereof, or services provided hereunder, then, upon written notice from PEABB given within the earlier of fifteen (15) Business Days after discovery of such defect or nonconformity or fifteen (15) Business Days after the end of the warranty period specified herein, Contractor shall promptly commence and shall complete, within a reasonable time after receipt of such notice and at Contractors sole expense, the correction of such defect or nonconformity. Contractor shall cause such correction to conform to the requirements of the Project Scope Document by re-designing, repairing, replacing or re-performing the defective or nonconforming Work. Contractor shall bear all costs incidental to such corrective action, including, without limitation, removal, disassembly, transportation, reinstallation, reconstruction, retesting, reinspection and re-performance as may be necessary to correct the defect or nonconformity. If it is determined that no defect or nonconformity exists after PEABB has submitted a warranty claim in accordance with this Section 10.2, PEABB shall reimburse Contractor for the cost of all corrective action taken by Contractor with respect to such claim to the extent reimbursed by Owner for such corrective action. The one-year term established herein shall be extended as to any portion of the Work which is re-designed, repaired, replaced or re-performed for a period equal to the longer of (i) six (6) months or (ii) the remaining term of the original one (1) year warranty term specified herein from the date of completion of any remedial work performed pursuant to this Section 10.2. If Contractor fails or refuses to promptly make the necessary re-design, repair, replacement, retests or re-performance, PEABB may perform or cause to be performed the same and Contractor shall promptly reimburse PEABB for all costs incurred thereby. Such action by PEABB shall not be deemed or construed to be a waiver of any other remedy PEABB may have under this Agreement in respect of such failure or refusal.

10.3 Subcontractor Warranties. Contractor shall use its reasonable commercial efforts to obtain warranties from its Subcontractors identical to the warranties given by Contractor in Section 10.2; provided, however, that Contractor shall not be relieved of any obligation hereunder due to its failure to obtain, or the failure or the refusal of any Subcontractor to perform under, any such warranty. Where Contractor obtains design, equipment, materials or other warranties from its Subcontractors which are in addition to or more favorable than the warranties contained in this Agreement, Contractor shall enforce such warranties for the benefit of PEABB and Owner to the fullest extent possible under the terms of such warranties, and shall assign all such warranties to Owner.

10.4 Exclusion from Warranties. The warranties set forth in this Section 10 do not cover or include defects or nonconformities resulting from: (i) improper operation or repairs by Owner or persons not under Contractor's direct or indirect (whether through its Subcontractors or otherwise) supervision that are not specifically approved in writing by Contractor; (ii) normal wear; (iii) improper installation (unless performed by Contractor or its Subcontractors); (iv) improper maintenance, misuse, abuse, neglect,

improper storage of spare parts by Owner (or any contractor of Owner other than Contractor or any Subcontractor) or accident; or (v) items that are consumable or normally replaced during maintenance, unless such items are defective.

10.5 Disclaimer. EXCEPT AS EXPRESSLY SET FORTH IN SECTION 3.13 AND THIS SECTION 10, CONTRACTOR MAKES NO WARRANTIES WITH RESPECT TO THE WORK, EXPRESSED OR IMPLIED, IN FACT OR ARISING BY OPERATION OF LAW (INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE).

11. TERMINATION

11.1 Default by Contractor. For the purposes of this Agreement, each of the following events shall be deemed an "Event of Default"):

11.1.1 Contractor shall default in the payment of any undisputed sum due and payable to PEABB hereunder and such default shall continue for twenty (20) Business Days after receipt of written notice from PEABB that such payment is due and payable;

11.1.2 Contractor shall fail to diligently pursue completion of the Work;

11.1.3 Contractor shall fail to complete the Work and satisfy the conditions precedent for Substantial Completion for a Unit set forth in Section 6.2 within one hundred eighty (180) days after the Scheduled Substantial Completion Date for any Unit or fail to complete the Work and satisfy the conditions precedent for Final Completion set forth in Section 6.5 within one hundred eighty(180) days after the Substantial Completion Date for the last Unit for any reason except to the extent that(a)a suspension of Work pursuant to Section 16 to the extent such delay allows Contractor to extend the Contract Milestone Schedule, (b) delays to Contractor's performance to the extent such delays are excused under Section 14 or (c) any other delay to the extent that such delay is caused by PEABB where such delays are not the result of a breach by Contractor of its obligations hereunder;

11.1.4 Contractor shall default in any material respect in obtaining and maintaining the insurance policies required hereunder through Final Completion;

11.1.5 Contractor shall default in any material obligation of Contractor contained herein (other than those obligations covered by Sections 11.1.1 through and including 11.1.4), and Contractor fails to cure such default within fifteen (15) days after written notice to Contractor specifying the material default and demanding the same be remedied, or if such default cannot be cured within such fifteen (15) day period, fails to commence cure within such fifteen (15) day period and diligently pursue cure to completion within the time period mutually agreed upon between PEABB and Contractor before commencement of such cure;

11.1.6 Any representation or warranty made by Contractor herein or in any certificates, statements, or documents given pursuant to the terms of this Agreement shall prove to be false or misleading to the extent that it constitutes a material default in any material obligation of Contractor contained herein, and any material adverse consequences to Owner directly caused thereby shall not have been remedied within fifteen (15) days after written notice to Contractor specifying the material default and demanding the same be remedied, or if such default cannot be

cured within such fifteen (15) day period, fails to commence cure within such fifteen (15) day period and diligently pursue cure to completion within the time period mutually agreed upon by PEABB and Contractor before commencement of such cure;

11.1.7 (i) Contractor or Guarantor (if any) shall: (a) file a petition commencing a voluntary case under any Peruvian or United States, as applicable, state or federal bankruptcy law; (b) file a petition for liquidation, reorganization, or an arrangement pursuant to any Peruvian or United States, as applicable, federal or state bankruptcy law; (c) be adjudicated a debtor or be declared bankrupt or insolvent under any Peruvian or United States, as applicable, federal or state law relating to bankruptcy, insolvency, winding-up, or adjustment of debts, as now or hereafter in effect; (d) make an assignment for the benefit of creditors; (e) admit in writing its inability to pay its debts as they become due; or (ii) if a petition commencing an involuntary case under any Peruvian or United States, as applicable, federal or state bankruptcy law shall have been commenced against Contractor or Guarantor (if any) or an answer proposing the adjudication of Contractor or Guarantor (if any) as a debtor or a bankrupt or proposing its liquidation or reorganization pursuant to any federal or state bankruptcy law shall have been filed in any court and Contractor or Guarantor (if any) shall consent to or acquiesce in the filing thereof, or such petition or answer shall not be discharged or denied within thirty (30) days after the filing thereof; or

11.1.8 A custodian, receiver, trustee or liquidator of Contractor or Guarantor (if any), or of all or substantially all of the assets of Contractor or Guarantor (if any), shall be appointed in any proceeding brought against Contractor or Guarantor and shall not be discharged within sixty (60) days after such appointment, or if Contractor or Guarantor (if any) shall consent to or acquiesce in such appointment.

At any time after the occurrence and during the continuance of an Event of Default, PEABB may, at its option:(a) terminate this Agreement by written notice to Contractor; (b) take control of the Units; and (c) recover from Contractor an amount equal to the cost of completing the Work less the unpaid portion of the Contract Price, as a consequence of Contractor's default hereunder and as damages for loss of bargain and not as a penalty. In addition, Contractor shall be liable for the reasonable costs and expenses incurred by PEABB by reason of the occurrence of any Event of Default by Contractor, or the exercise of PEABB's remedies with respect thereto, including all costs and expenses incurred in connection with the turnover of the Units to Owner, the completion of the Work by PEABB or any third party and any suit to enforce PEABB's rights.

PEABB's remedies set forth in this Section shall not be exclusive, but shall be cumulative and may be exercised concurrently or consecutively with, and shall be in addition to, all other remedies PEABB may have under this Agreement.

11.2 Termination for PEABB's Convenience. PEABB may terminate the Work and this Agreement, in whole or in part, at any time by written notice to Contractor. Upon such termination, PEABB shall pay to Contractor an amount equal to any proven reasonable loss sustained upon any materials, labor, equipment, tools, construction equipment, machinery, and costs of termination of subcontracts and other project costs, related contracts and commitments, as well as demobilization costs and a reasonable profit on Work performed through the date of termination, less any amounts previously paid by PEABB hereunder.

11.3 Effect of PEABB Termination. Upon receipt of any termination notice pursuant to Section 11.1 or 11.2, Contractor shall:

11.3.1 Stop the performance of all Work and services hereunder, except as may be necessary to carry out such termination or as otherwise directed by PEABB;

11.3.2 Issue no further purchase orders and enter into no further contracts relating to the Work, except with the prior written consent of PEABB;

11.3.3 In the case of termination pursuant to Section 11.1 only, assign to PEABB or Owner, upon request, all rights of Contractor under contracts or purchase orders entered into by Contractor in connection with the Work;

11.3.4 To the extent possible, upon PEABB's request, terminate existing contracts and purchase orders entered into by Contractor in connection with the Work; and

11.3.5 Take any other action necessary to terminate the Work and Contractor's services hereunder which PEABB shall direct.

Upon such termination, PEABB shall be entitled to any equipment and materials which have been delivered to the Facility Site or to Contractor's off-site storage facility and to all Documents, whether partial or complete, then in the possession of Contractor or its Subcontractors.

Upon such termination and effective therewith, Contractor shall be deemed to have waived any claim for damages as a result of such termination, including loss of anticipated profits on account of this Agreement, as long as PEABB shall have paid Contractor (i) for all amounts due to Contractor up to the date of termination in accordance with the provisions of Section 7 and (ii) in the event of a termination pursuant to Section 11.2 only, the amount set forth therein.

11.4 PEABB's Right to Carry Out the Work. If Contractor shall default in or neglect to carry out any of its obligations hereunder and shall fail within five (5) Business Days after receipt of written notice from PEABB to (a) commence and continue to completion correction of such default or neglect with diligence and promptness, or (b) provide reasonable evidence that such default or neglect does not exist, PEABB may, without prejudice to any other remedy it may have, correct such default or neglect. In such case, the cost of correcting such default or neglect shall be deducted from the payments then or thereafter due Contractor, and if no such payments are so due or such cost exceeds the balance due, Contractor shall pay to PEABB such cost or the portion in excess of the balance due Contractor within ten (10) Business Days of receipt of an invoice therefor. The exercise by Owner of its rights under this Section 11.4 shall not diminish any of Contractor's obligations hereunder or relieve Contractor from full compliance with the requirements hereof.

11.5 Termination by Contractor. Contractor may by written notice to PEABB stop performance of this Agreement and terminate this Agreement effective as of the date set forth in such notice, provided that such date shall be no earlier than thirty (30) days after Owner receives such notice, only on account of any of the following circumstances:

11.5.1 Unless an Affiliated Company, Owner, Lender or another financially responsible person or entity reasonably acceptable to Contractor timely assumes the obligations of PEABB hereunder, PEABB shall (a) file a petition commencing a voluntary case under any Peruvian bankruptcy law, (b) file a petition for

liquidation, reorganization, or for an arrangement pursuant to any Peruvian bankruptcy law, (c) be adjudicated a debtor or be declared bankrupt or insolvent under any Peruvian law as now or hereafter in effect relating to bankruptcy, insolvency, winding-up or adjustment of debts, (d) make an assignment for the benefit of creditors, (e) admit in writing its inability to pay its debts as they become due or (f) if a petition commencing an involuntary case under any Peruvian bankruptcy law or an answer proposing the adjudication of PEABB as a debtor or a bankrupt or proposing its liquidation or reorganization pursuant to any Peruvian bankruptcy law shall be filed in any court and PEABB shall consent to or acquiesce in the filing thereof or such petition or answer shall not be discharged or denied within sixty (60) days after the filing thereof;

11.5.2 Unless an Affiliated Company, Owner, Lender or another financially responsible person or entity reasonably acceptable to Contractor timely assumes the obligations of PEABB hereunder, a custodian, receiver, trustee or liquidator of PEABB or of all or substantially all of the assets of PEABB, shall be appointed in any proceeding brought against PEABB and shall not be discharged within sixty (60) days after such appointment, or if PEABB shall consent to or acquiesce in such appointment; or

11.5.3 Unless an Affiliated Company, Owner, Lender or another financially responsible person or other entity reasonably acceptable to Contractor timely assumes the obligations of PEABB, PEABB shall default in material respect in the observance or performance of any covenant, condition, or obligation of PEABB contained herein and such default shall continue for sixty (60) days after written notice to PEABB specifying the default and demanding that the same be remedied.

11.5.4 Unless an Affiliated Company, Owner, Lender or another financially responsible person or other entity reasonably acceptable to Contractor timely assumes the obligations of PEABB, PEABB shall default in the payment of any undisputed sum due and payable hereunder and such default shall continue for ten (10) Business Days after receipt of written notice from Contractor that such payment is due and payable. In addition to Contractor's right to terminate, the parties agree that in the event of a default described in Section 11.5.4, Contractor has the right to immediately suspend the Work without additional notice until such undisputed sum is paid.

Notwithstanding the foregoing, in the event that any party assumes the obligations of PEABB hereunder, Contractor shall have no obligation to continue performance unless Contractor is paid all sums then due under this Agreement at the time that the PEABB's obligations are assumed.

12. LIQUIDATED DAMAGES; BONUSES

12.1 General. The parties hereby acknowledge and agree that in the event that Substantial Completion for a Unit has not occurred on or before the Scheduled Substantial Completion Date with respect to such Unit, Owner will suffer damages in an amount that is not susceptible to calculation with reasonable certainty. Therefore, the parties agree that the liquidated damages set forth herein represent a reasonable determination of the amount of damages that Owner will suffer and are not penalties. Contractor hereby waives any defense to Owner's recovery of such liquidated damages on the basis that such liquidated damages do not represent a reasonable determination of Owner's damages or are penalties.

12.2 Late Completion. If Substantial Completion for a Unit has not occurred on or before the Scheduled Substantial Completion Date for such Unit, Contractor shall pay to

Owner as liquidated damages and not as a penalty, for each day from and including the Scheduled Substantial Completion Date for a Unit and continuing to and including the Substantial Completion Date for such Unit, the following amounts:

Units	Scheduled Substantial Completion Date	Amount Per Unit Per Day
First and Second Unit	October 31, 1998	U.S.$ 9,800
Third and Fourth Unit	April 30, 1999	U.S.$10,000
Fifth and Sixth Unit	November 9, 1999	U.S.$27,000

In addition to the above amounts, to the extent the Government of Peru or any Governmental Authority thereof imposes late completion damages on Owner or any of its shareholders in connection with the Expansion Obligation, Contractor shall pay PEABB, as liquidated damages and not as a penalty, for each calendar day from the Scheduled Substantial Completion Date for a Unit until and including the Substantial Completion Date for such Unit, an amount equal to the product of (i) U.S.$200 multiplied by (ii) the megawatt deficiency below the ninety (90) megawatt aggregate increase in the Facility's generating capacity expected upon completion of the Work that is caused by failure to achieve the Substantial Completion for such Unit by the Scheduled Substantial Completion Date thereof. Contractor's obligation under this paragraph shall apply only if, and to the extent that, late completion damages are imposed on PEABB after November 9, 1999.

Contractor shall make any payment required under this Section 12.2 with respect to a Unit within the earlier of (i) thirty (30) days after the Substantial Completion Date for such Unit or (ii) ninety (90) days after the Scheduled Substantial Completion Date for such Unit.

The liquidated damages specified herein shall not apply to the extent that any delay in achieving Substantial Completion: (i) is solely caused by PEABB, where such delays are not the result of a breach by Contractor of its obligations hereunder; (ii) results from Force Majeure Events affecting Contractor's ability to perform hereunder; or (iii) a suspension of Work pursuant Section 16 allows Contractor to extend the Contract Milestone Schedule.

Contractor shall not take the third and fourth Units out of service or commence Work thereon before Substantial Completion has been achieved for the first and second Units. In addition, Contractor shall not take the fifth and sixth Units out of service or commence Work thereon until Substantial Completion has been achieved for the first, second, third and fourth Units.

The liquidated damages established herein shall be in lieu of all liability of Contractor for payment of damages for extra costs, losses or expenses, claims and penalties, loss of the use of the Facility, cost of capital (including interest), loss of revenue or other damages, that are occasioned by or result solely from any delay in achieving Substantial Completion for a Unit by the Scheduled Substantial Completion Date for such Unit; provided, however, that the payment of liquidated damages by Contractor under this Section 12.2 shall not affect Owner's right to terminate this Agreement after Contractor's payment of such liquidated damages for a period of one hundred eighty (180) days and recover the cost of completion in accordance with the provisions of Section 11.1.

12.3 Early Completion. If Substantial Completion for any Unit shall occur before the Scheduled Substantial Completion Date for such Unit, then the PEABB shall pay to Contractor a bonus ("the Early Completion Bonus") for the period from and including the Substantial Completion Date for such Unit to, but excluding, the Scheduled Substantial Completion Date (such period, the "Early Completion Bonus Period") for such Unit in the following amounts specified in this Section 12.3 per such Unit per day. Contractor shall receive twenty-five percent (25%) of the aggregate Early Completion Bonus earned by PEABB as specified and limited in this Section 12.3.

12.3.1 Early Completion Bonus for the First Four Units Substantially Completed. The Early Completion Bonus, if any, payable by PEABB to Contractor for the first four Units in respect of which Substantial Completion is achieved shall be the following amount per Unit per day:

Unit	Scheduled Substantial Completion Date	Amount per Unit per Day
First and Second Unit	October 31, 1998	U.S.$1,960
Third and Fourth Unit	April 30, 1999	U.S.$2,000

12.3.2 Early Completion Bonus for Fifth Unit Substantially Completed. The Early Completion Bonus, if any, payable by PEABB to Contractor for the fifth Unit in respect of which Substantial Completion is achieved shall be the greater of:

(i) U.S.$1,000 per day during the Early Completion Bonus Period; and

(ii) the sum of the Fifth Unit Daily Bonus computed for each day during the Early Completion Bonus Period for the fifth Unit in respect of which Substantial Completion is achieved.

For the purposes of this Section 12.3.2, the "Fifth Unit Daily Bonus" shall mean, with respect to any day in the Early Completion Bonus Period for the fifth Unit in respect of which Substantial Completion is achieved: (i) in cases in which the date on Table 12.3 corresponding to such day specifies an estimated long term average flow number greater than fifty and twenty-two hundredths (50.22) cubic meters per second ("CMS") but less than sixty (60) CMS, the product of (A) U.S.$450 per CMS multiplied by (B) the difference between the estimated long term average flow number specified on Schedule 12.3 for such date and forty-eight (48) CMS; and (ii) in cases in which the date on Table 12.3 corresponding to such day specifies an estimated long term average flow number greater than sixty (60) CMS, U.S.$5,400.

As an illustration of the definition of Fifth Unit Daily Bonuses, the Fifth Unit Daily Bonus for October 19 and October 22 are set forth below:

Date	Specified Flow	Base	Difference	Rate	Fifth Unit Daily Bonus
October 19	58.16	48.00	10.16	$450	U.S.$4,572
October 22	59.77	48.00	11.77	$450	U.S.$5,297

12.3.3 Early Completion Bonus for Sixth Unit Substantially Completed. The Early Completion Bonus, if any, payable by Owner to Contractor for the sixth Unit in respect of which Substantial Completion is achieved shall be the greater of:

(i) U.S.$1,000 per day during the Early Completion Bonus Period; and

(ii) the sum of the Sixth Unit Daily Bonuses computed for each day during the Early Completion Bonus Period for the sixth Unit in respect of which Substantial Completion is achieved.

For the purposes of this Section 12.3.3, the "Sixth Unit Daily Bonus" shall mean, with respect to any day in the Early Completion Bonus Period for the sixth Unit in respect of which Substantial Completion is achieved: (i) in cases in which the date on Table 12.3 corresponding to such day specifies an estimated long term average flow number greater than sixty-two and twenty-two hundredths (62.22) CMS but less than seventy-two (72) CMS, the product of (A) U.S.$450 per CMS multiplied by (B) the difference between the estimated long term average flow number specified on Schedule 12.3 for such date and sixty (60) CMS; and (ii) in cases in which the date on Table 12.3 corresponding to such day specifies an estimated long term average flow number greater than seventy-two (72) CMS, U.S.$5,400.

As an illustration of the definition of the Sixth Unit Daily Bonus, the Sixth Unit Daily Bonus for October 25 and October 30 are set forth below:

Date	Specified Flow	Base	Difference	Rate	Sixth Unit Daily Bonus
October 25	67.88	60.00	7.88	$450	U.S.$3,546
October 30	67.70	60.00	7.70	$450	U.S.$3,465

12.3.4 Maximum Aggregate Early Completion Bonus; Payment. The maximum aggregate Early Completion Bonuses payable under Sections 12.3.1 through and including 12.3.3 shall not exceed U.S.$750,000.

The Early Completion Bonus for any Unit shall be payable within thirty (30) days after the Substantial Completion Date for such Unit.

12.4 Limitation on Liability.

(a) In no event shall the aggregate liquidated damages paid by Contractor pursuant to Sections 12.2 exceed thirty percent (30%) of the Contract Price.

(b) In no event shall Contractor's aggregate liability (including, without limitation, the costs of performing its warranty obligations hereunder) for any damages (including, without limitation, liquidated damages paid by Contractor pursuant to Section 12.2) arising out of this Agreement, exceed the sum of: (i) the Contract Price plus (ii) the amount necessary to satisfy its indemnification obligations under Section 9; provided, that in no event shall Contractor's indemnity obligations under Section 9.1.1 relating to physical damage or physical loss to tangible property exceed U.S.$100,000 per event of such damage or loss.

(c) In no event shall PEABB's indemnity obligations under Section 9.2.1 relating to physical damage or physical loss to tangible property exceed U.S.$100,000 per event of such damage or loss.

(d) In no event, whether in contract, tort, negligence, strict liability or otherwise, shall either party be liable to the other party or its affiliates, subcontractor or suppliers for any consequential, incidental, indirect or special damages (including, without limitation, loss of profits or revenue, loss of data, loss of use of facilities, cost of capital, cost of substitute facilities, equipment or services, downtime costs, costs of replacement steam or electric power) for any reason arising out of this Agreement or performance or non-performance hereunder or in connection with the Work, except for such liquidated damages as are specifically provided under Sections 12.2 and 12.4, costs incurred to effect the remedy provided in Section 10.2 and indemnity obligations as set forth in this Agreement. Nothing in this Section 12.6(c) shall limit the right of Contractor to receive payment in accordance with the terms of this Agreement.

(e) This Section 12.4 shall prevail over any conflicting or inconsistent provision contained in this Agreement.

DISPUTE RESOLUTION

Dispute Resolution. In the event of a dispute or controversy between PEABB and Contractor arising out of or related to this Agreement, the aggrieved party shall notify the other party of such dispute or controversy by a date no later than ten (10) Business Days after such dispute or controversy arises. If the parties have failed to resolve such dispute or controversy within (10) Business Days after receipt of such notice, each party, within five (5) Business Days thereafter, shall nominate a senior officer of its management to meet at the Facility, or such other mutually agreed location, to resolve such dispute or controversy. If the parties are unable to resolve such dispute or controversy to their mutual satisfaction within thirty (30) days after such meeting, each party shall have the right to file a demand for final and binding arbitration, which shall be conducted in Lima, Peru or another mutually agreed upon location in accordance with the then current Rules of Conciliation and Arbitration of the International Chamber of Commerce. The foregoing agreement to arbitrate shall be specifically enforceable in any court of competent jurisdiction.

The arbitrator shall either be an attorney or retired judge familiar with the subject matter of the dispute. Until the final decision is made by the arbitrator, the parties may continue to attempt to mutually agree upon a resolution. Such a resolution shall include a determination of all costs, including, without limitation, all costs of the arbitrator and each party. The arbitrator shall be bound by all provisions of this Agreement, and shall have no power or authority to enter an award that is in conflict with the provisions of this Agreement. Any award that is in conflict with the provisions of this Agreement shall be null and void, and shall be vacated on the grounds that it exceed the power of the arbitrator.

Subject to the immediately preceding paragraph, the determination of the arbitrator shall be final and binding, and judgment may be entered in any court having proper jurisdiction thereof.

13.2 Performance During Dispute. Subject to the rights of the parties to terminate this Agreement or suspend the Work as set forth in this Agreement, the parties shall perform their respective obligations under this Agreement during the pendency of any dispute resolution.

14. FORCE MAJEURE

14.1 No party hereunder shall be considered in default in the performance of, and such party shall be excused from performing, any obligatlon (except a payment obligation) under this Agreement to the extent that and only for so long as such performance is prevented by reason of any cause that is beyond such party's reasonable control and not caused by such party's fault or negligence (such cause, a "Force Majeure Event"). Force Majeure Events shall include, but not limited to, acts of God or the public enemy, natural disasters, earthquakes, lightning, storms, unusually severe weather, riots, wars, fires, floods, accidents, strikes or other labor disputes (excluding local strikes brought by crafts signatory to Contractor's project labor agreement for the Work and directed against Contractor because of Contractor's acts or omissions at the Facility) affecting the Work or the Facility directly, transportation embargoes or delays, utility interruptions, civil disturbances, or acts or omissions of Governmental Authorities.

14.2 Upon the occurrence of any Force Majeure Event, the party affected shall (a) promptly advise the other party of such event and (b) use all reasonable efforts to minimize the effect of any such Force Majeure Event on the Work or the Facility and to restore such party's ability to perform hereunder; provided, however, that neither party shall be obligated to settle any labor dispute except on terms satisfactory to such party, in its sole discretion. To the extent that any Force Majeure Event delays Contractor's ability to perform hereunder, Contractor shall be entitled to an equitable adjustment to the Contract Milestone Schedule and the Scheduled Substantial Completion Date if Contractor has complied with this Section 14.2, but shall not be entitled to any adjustment to the Contract Price.

15. CONFIDENTIAL INFORMATION

The terms and conditions of this Agreement, and any information provided by either party to the other that is designated in writing by the disclosing party as confidential, shall be held in confidence by the receiving party. The receiving party shall not disclose such information to third parties without the prior written consent of the disclosing party, except as may be necessary: (a) to perform such party's obligations under this Agreement; (b) to comply with applicable laws, rules, orders or regulations; or (c) to comply with reasonable requests of Owner, Lender, Lender's Engineer, investors or potential investors, as reasonably determined by Owner to be necessary. The restrictions of this Section 15 shall not apply to the extent such confidential information (i) was previously in the possession of the receiving party, (ii) was obtained by the receiving party from a third party not subject to any restriction on its disclosure, (iii) was in the public domain or becomes part of the public domain through no fault of the receiving party or (iv) is required to be disclosed by applicable law, rule, regulation or court order. Contractor shall require similar confidentiality obligations from Subcontractors to whom Contractor needs to disclose any of PEABB's confidential information. In the event either party is required by law to disclose any of the other party's confidential information, the disclosing party shall use its best efforts, in cooperation with the other party, to protect such information from further disclosure.

16. SUSPENSION OF THE WORK

16.1 Right to Suspend. PEABB may suspend Contractor's performance of the Work,in whole or in part, at any time upon five (5) days prior written notice of such suspension.

Thereafter, Contractor shall resume the full performance of the Work only when directed to do so by written notice from PEABB.

16.2 Effect of Suspension. Any suspensions by PEABB of the Work shall constitute a Change. Contractor shall be entitled to an equitable adjustment for increased direct costs reasonably incurred by Contractor in suspending the Work plus ten percent (10%). Notwithstanding the preceding sentences, Contractor shall be entitled to an equitable adjustment in the Contract Milestone Schedule.

17. COVENANTS OF CONTRACTOR RELATING TO CONSTRUCTION FINANCING

17.1 Contractor Cooperation. Upon PEABB's reasonable request, Contractor shall cooperate with Owner to enable Owner to obtain financing in respect of all or part of the Work (including, without limitation, financing of exported equipment to be included in the Work, which financing may be sought in the country of manufacture).

17.2 Documentation in Connection with Progress Payments. Contractor shall provide, execute and deliver to PEABB, or at PEABB's request, to Owner and/or Lender, such documents, certificates, instruments and information as shall be within the control of Contractor to provide and as may be reasonably requested as a condition to any Progress Payment. In particular, Contractor shall certify to PEABB, on and as of the date of each Progress Payment, that (a) all conditions to be satisfied by Contractor on or before such date have been satisfied, (b) Contractor is not in default under this Agreement, and no condition or circumstance exists that with the giving of notice or expiration of the cure period designated in Section 11 with respect to such condition or circumstance would constitute an Event of Default by Contractor under this Agreement, (c) all representations of Contractor set forth in this Agreement and any certificate previously delivered by Contractor are true and complete, (d) all insurance policies required under this Agreement are in full force and effect and (e) the Facility and the Facility Site have not been encumbered by any mechanics', materialmen's or other liens to the extent Contractor has been paid in accordance with this Agreement, other than Permitted Liens.

18. MISCELLANEOUS PROVISIONS

18.1 Assignment. This Agreement shall not be assigned by either party without the prior written consent of the other party, except that PEABB may assign or collaterally assign this Agreement and its interest and obligations hereunder to an Affiliated Company, Owner, Lender or any financial institution or institutions participating in the Project Financing or permanent financing of the Facility.

18.2 Successors and Assigns. This Agreement shall be binding and inure to the benefit of the parties to this Agreement and any successor or permitted assignee.

18.3 Amendments. This Agreement may be amended or modified only by a written agreement signed by officers of the parties.

18.4 Relationship of the Parties. Nothing in this Agreement shall be deemed to constitute either party a partner, agent or legal representative of the other party or to create any fiduciary relationship between the parties. Contractor is and shall remain an independent contractor in the performance of this Agreement, maintaining complete control of its personnel, workers, subcontractors and operations required for performance of the Work.

18.5 Notices. All notices, consents and other communications required or permitted by this Agreement shall be in writing and shall be deemed to have been given when delivered by hand or by facsimile (with a confirmation of transmittal thereof received by sender) to an authorized representative or officer of any party, or one (1) day after having been deposited with a internationally recognized commercial courier for overnight delivery and addressed as follows:

If to Contractor:

GyM S.A.
Paseo de la Republica 4675 Surquillo
Lima 34
Peru
Facsimile: 51-1-241-7635
Attention: Augustín Olavide

If to PEABB:

Asea Brown Boveri S.A.
Av. Argentina 3120 - Lima 1
P.O. Box 3846 - Lima 100
Peru
Facsimile: 51-1-561-2902
Attention: José Barbe

with a copy to:

ABB Power Generation Inc., Hydro Power Division
Suite 208 View Point II
7921 SouthPark Plaza
Littleton, Colorado 80120
Facsimile: 303-730-4112
Attention: Scott Torvik

18.6 Waiver. Neither party's failure to insist on strict performance of any provision of this Agreement or to exercise any right hereunder shall be construed as a waiver or relinquishment of such party's right to rely upon such provisions or rights, unless such waiver is in writing. Neither party's waiver of any provision of this Agreement or any breach hereunder, shall be deemed to apply thereafter to any other or subsequent provision, right, or breach.

18.7 Severability. If any of the provisions of this Agreement, or portions or applications thereof, are held to be unenforceable or invalid by any court of competent jurisdiction, the validity and enforceability of the remaining provisions, or portions or applications thereof, shall not be affected thereby.

18.8 Survival. Obligations of the parties that are by the terms hereof to be performed or satisfied after the Final Completion Date, including any warranties and remedial obligations of Contractor hereunder, indemnity obligations and confidentiality restrictions, shall continue in full force and effect notwithstanding the occurrence of the Final Completion Date.

18.9 Headings. Captions and headings in this Agreement are for reference only and do not constitute a part of the substance of this Agreement.

18.10 Counterparts. This Agreement may be executed in multiple counterparts, each of which shall be deemed to be an original, but all of which together constitute one instrument.

18.11 Entire and Complete Agreement. This Agreement and the Appendices attached hereto constitute the entire and complete understanding of Contractor and PEABB and supersedes all previous and contemporaneous understandings and communications (including, without limitation, the Release) with respect to the subject matter hereof.

18.12 Applicable Law. The laws of Peru shall govern the validity, interpretation, construction and performance of this Agreement.

18.13 No Third Party Beneficiaries. This Agreement is intended to be solely for the benefit of PEABB and Contractor and their successors and permitted assignees and is not intended to and shall not confer any rights or benefits on any third party (other than successors and permitted assignees) not a signatory hereto.

18.14 Hazardous Material. Contractor shall not bring any Hazardous Material onto the Facility Site. If Contractor brings Hazardous Material onto the Facility Site, Contractor shall be liable for such Hazardous Material and any Hazardous Material brought onto the Facility Site by Contractor, any Subcontractor and any agents thereof, and shall be required to perform any cleanup, removal or other disposition with respect thereto.

If, during Contractor's performance of the Work, Contractor becomes aware of any Hazardous Material on the Facility Site, not created or brought on-site by Contractor or of which Contractor has not been previously notified by PEABB, Contractor shall report such condition to PEABB in writing. Contractor shall not be liable for any Hazardous Material on or under the Facility Site brought on, or created on the Facility Site, by PEABB,Owner, or their respective agents or representatives and shall not be required to perform any cleanup, removal or other disposition with respect thereto.

IN WITNESS WHEREOF, Owner and Contractor have caused this Agreement to be executed by their duly authorized representatives as of the day and year first written above.

GyM S.A.

By:_____
Name: Luis Vinatea
Title: Gerente División Electomecánica

ASEA BROWN BOVERI S.A.

By:_____
Name: Jose Barbe
Title: General Manager - Generation

By:_____
Name: Eduardo San Martin
Title: Controller

Appendix B

Cañon del Pato Expansion GMA Payment Schedule

Project Month	Date	Progress Payment	Billing Amount (US Dollars)	Retention	Retention (US Dollars)	Retention Paid (US Dollars)	Contract Milestone
1	Apr-97	5%	$195,481	10%	$ 19,548		
2	May-97						
3	Jun-97						
4	Jul-97	5%	$195,481	10%	$ 19,548		
5	Aug-97						
6	Sep-97						
7	Oct-97	5%	$195,481	10%	$ 19,548		
8	Nov-97						
9	Dec-97						
10	Jan-98	5%	$195,481	10%	$ 19,548		
11	Feb-98						
12	Mar-98						
13	Apr-98	4%	$156,384	10%	$ 15,638		Start 1st Outage
14	May-98	4%	$156,384	10%	$ 15,638		
15	Jun-98	4%	$156,384	10%	$ 15,638		
16	Jul-98	4%	$156,384	10%	$ 15,638		
17	Aug-98	4%	$156,384	10%	$ 15,638		
18	Sep-98	4%	$156,384	10%	$ 15,638		
19	Oct-98	4%	$156,384	10%	$ 15,638		S.C. 1st & 2nd units
20	Nov-98	4%	$156,384	10%	$ 15,638	$40,660	Start 2nd Outage
21	Dec-98	4%	$156,384	8%	$ 12,511		
22	Jan-99	4%	$156,384	8%	$ 12,511		
23	Feb-99	4%	$156,384	8%	$ 12,511		
24	Mar-99	4%	$156,384	8%	$ 12,511		
25	Apr-99	4%	$156,384	8%	$ 12,511		S.C. 3rd & 4th units
26	May-99	4%	$156,384	8%	$ 12,511	$59,426	Start 3rd Outage
27	Jun-99	4%	$156,384	6%	$ 9,383		
28	Jul-99	4%	$156,384	6%	$ 9,383		
29	Aug-99	4%	$156,384	6%	$ 9,383		
30	Sep-99	4%	$156,384	6%	$ 9,383		
31	Oct-99	4%	$156,384	6%	$ 9,383		S.C. 5th & 6th units
32	Nov-99	4%	$156,384	6%	$ 9,383	$234,577	F.C. of Contract
		100%	$3,909,610		$ 334,663	$334,663	

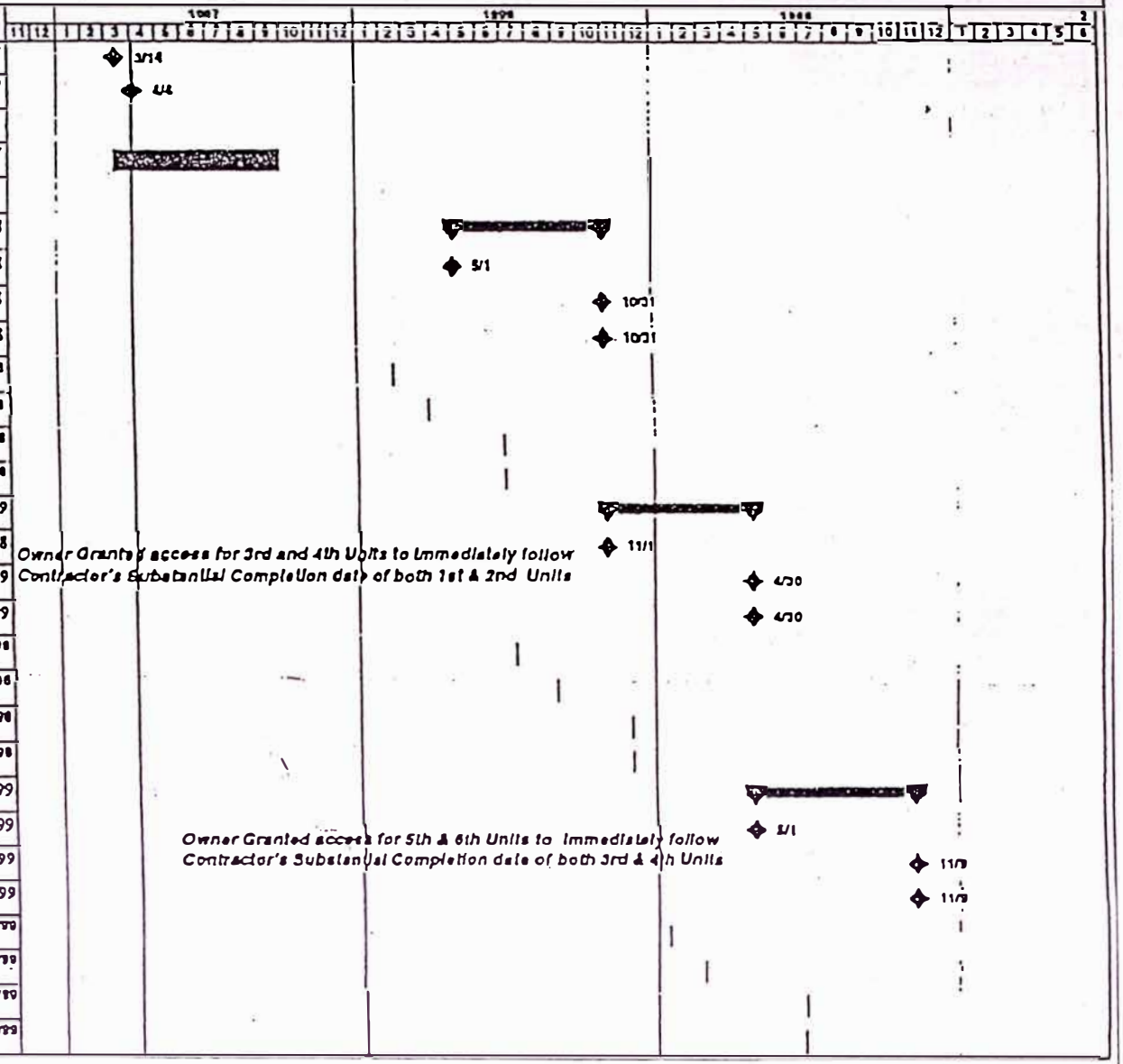
All GMA pricing as per April 24, 1997 fax (US$3,758,191) with the exception of price adders for April 16, 1997 bond pricing (US$77,417), April 1, 1997 Hydraulic/Mathematical Model for Discharge Tunnel Modifications (US$35,000), and June 12,1997 letter for additional insurance coverage (US$39,000).

S.C. = Substantial Completion, F.C. = Final Completion.

Retention interest net present value will be calculated. This amount will be moved from Month 32 billing to Month 1 billing.

Canon del Pato Project - Appendix C
Contract Milestone Schedule

ID	Task Name	Start	Finish
1	Release Engineering Data	Fri 3/14/97	Fri 3/14/97
2	Contract Award	Fri 4/4/97	Fri 4/4/97
3			
4	Main Engineering	Fri 3/14/97	Tue 9/30/97
5			
6	1st & 2nd unit Milestones	Fri 5/1/98	Sat 10/31/98
7	Owner granted access to 1st & 2nd units	Fri 5/1/98	Fri 5/1/98
8	Substantial Completion Date of 1st unit	Sat 10/31/98	Sat 10/31/98
9	Substantial Completion Date of 2nd unit	Sat 10/31/98	Sat 10/31/98
10	1st unit Generator Shipment	Mon 2/16/98	Mon 2/16/98
11	2nd unit Generator Shipment	Mon 3/30/98	Mon 3/30/98
12	1st unit Runner Shipment	Wed 7/1/98	Wed 7/1/98
13	2nd unit Runner Shipment	Thu 7/2/98	Thu 7/2/98
14	3rd & 4th unit Milestones	Sun 11/1/98	Fri 4/30/99
15	Owner granted access to 3rd & 4th units	Sun 11/1/98	Sun 11/1/98
16	Substantial Completion Date of 3rd unit	Fri 4/30/99	Fri 4/30/99
17	Substantial Completion Date of 4th unit	Fri 4/30/99	Fri 4/30/99
18	3rd unit Generator Shipment	Tue 7/14/98	Tue 7/14/98
19	4th unit Generator Shipment	Mon 8/31/98	Mon 8/31/98
20	3rd unit Runner Shipment	Tue 12/1/98	Tue 12/1/98
21	4th unit Runner Shipment	Wed 12/2/98	Wed 12/2/98
22	5th & 6th unit Milestones	Sat 5/1/99	Tue 11/9/99
23	Owner granted access to 5th & 6th units	Sat 5/1/99	Sat 5/1/99
24	Substantial Completion Date of 5th unit	Tue 11/9/99	Tue 11/9/99
25	Substantial Completion Date of 6th unit	Tue 11/9/99	Tue 11/9/99
26	5th unit Generator Shipment	Fri 1/15/99	Fri 1/15/99
27	6th unit Generator Shipment	Mon 3/1/99	Mon 3/1/99
28	5th unit Runner Shipment	Fri 7/2/99	Fri 7/2/99
29	6th unit Runner Shipment	Thu 7/1/99	Thu 7/1/99



Project: Canon del Pato Hydroelectric Project
Date: Thu 4/3/97

Task | Milestone | Rolled Up Task | Rolled Up Progress
Progress | Summary | Rolled Up Milestone

ANEXO 2

PRESUPUESTO META

ANEXO B

PRESUPUESTO META

GyM S.A.
LIMA - PERU
Client : ASEA BROWN BOVERI S. A.
Project : CAÑON DEL PATO EXPANSION

PRESUPUESTO META

	PARTIDAS	UND	CANT	C. UNIT US$	C. TOTAL US$
05	**Supervisión Directa de Obra**				
050001	Supervisión Directa de Obra	glb	1.00	$695,134.57	$695,134.57
10	**Movilización y desmovilización**				
100001	Movilización y desmovilización	glb	1.00	$192,884.68	$192,884.68
100002	Campamentos	glb	1.00	$233,400.00	$233,400.00
12	**Ingeniería del Proyecto**				
120001	Ingeniería del Proyecto (GMI)	glb	1.00	$250,000.00	$250,000.00
15	**Seguridad**				
150001	Implementos y equipos de seguridad	glb	1.00	$88,200.42	$88,200.42
150002	Medicinas	glb	1.00	$10,000.00	$10,000.00
20	**Obras Civiles**				
200001	Obras civiles	glb	1.00	$1,598,830.87	$1,598,830.87
25	**Obras Mecánico Eléctricas**				
250001	Obras mecánico eléctricas	glb	1.00	$1,606,920.71	$1,606,920.71
50	**Gastos Generales**				
500001	Gastos Generales	glb	1.00	$1,191,977.14	$1,191,977.14
55	**Gestión Extraordinaria**				
552000	Egresos Financieros	glb	1.00	$230,000.00	$230,000.00
	COSTO TOTAL (US$)				**$6,097,348.39**
	PRECIO DE VENTA (US$)				**$4,097,020.00**
	MARGEN (US$)				**-$2,000,328.39**
	MARGEN (% PRECIO DE VENTA)				**-48.82%**

GyM S.A.
LIMA - PERU
Client : ASEA BROWN BOVERI S. A.
Project : CAÑON DEL PATO EXPANSION

SUPERVISION DIRECTA DE OBRA

ITEM	SUPERVISION DIRECTA	CANT	MESES	C. UNIT. US$	LLSS 76.61%	C. TOTAL US$
1.00	**Area Mecánica Eléctrica**					
	Ing. Jefe de Montaje Mecánico	1.00	19.00	$1,450.00	$1,110.85	$48,656.06
	Ing. Jefe de Montaje Eléctrico					
	Ing. Jefe de Montaje Eléctrico/Oficina Técnica	0.50	23.00	$2,200.00	$1,685.42	$44,682.33
	Ing. Asistente Area Civil	1.00	6.00	$850.00	651.19	$9,007.11
	Supervisor de Obras Mecánicas	1.00	19.00	$2,400.00	$1,838.64	$80,534.16
	Supervisor de Soldadura					
	Supervisor de Obras Eléctricas	1.00	18.00	$1,200.00	$919.32	$38,147.76
	Supervisor de Instrumentación					
	Supervisión de soldadura					
	Calificación de soldadores					
	Operador Grua puente	1.00	18.00			
	Choferes	3.00	15.00	$1,600.00		$72,000.00
2.00	**Area Civil**					
	Ing. Jefe de Montaje Civil	1.00	12.00	$3,300.00	$2,528.13	$69,937.56
	Ing. Jefe de Montaje Civil	1.00	16.00	$2,200.00	$1,685.42	$62,166.72
	Supervisor de Obras Civiles	1.00	16.00	$1,200.00		$19,200.00
	Supervisor de Obras Civiles	1.00	8.00	$1,200.00	$919.32	$16,954.56
	Supervisor de Obras Civiles	1.00	16.00	$1,650.00		$26,400.00
	Supervisor de voladuras	1.00	9.00	$6,000.00		$54,000.00
	Laboratorista	1.00	14.00	$650.00	$497.97	$16,071.51
	Quimica Sol	1.00	5.00	$3,500.00		$17,500.00
	Guardián polvorin	1.00	12.00	$551.72		$6,620.69
	Choferes	2.00	15.00	$1,600.00		$48,000.00
3.00	**Equipos**					
	Camionetas	3.00		$10,000.00		$30,000.00
	Gasolina Camionetas	2.00	18.00	$300.00		$10,800.00
	Petroleo Camionetas	1.00	19.00	$300.00		$5,700.00
	Mantenimiento de camionetas	3.00	18.00	$200.00		$10,800.00
	Radios Portatiles SP-50 2chs c/cargador y bateria	6.00		$203.77		$1,222.62
	Radio Base-Movil Motorola SM 50 2CH-40 W	2.00		$266.75		$533.50
	Radios Motorola	16.00		$350.00		$5,600.00
	Radio Largo Alcance	1.00		$600.00		$600.00
	TOTAL SUPERVISION DIRECTA	**$695,134.57**				

GyM S.A.
LIMA - PERU
Client : ASEA BROWN BOVERI S. A.
Project : CAÑON DEL PATO EXPANSION

TABLA DE MOVILIZACION

DESCRIPCION	PRIMERA ETAPA	SEGUNDA ETAPA	TERCERA ETAPA	C. TOTAL (US$)
Equipos				
Area Electromecánica	**$4,000.00**	**$3,000.00**		**$7,000.00**
Módulo hidráulico	$3,000.00	$3,000.00		$6,000.00
Camión HIAB	$500.00			$500.00
Equipos de arenado	$500.00			$500.00
Cama baja				
Area Civil	**$33,950.00**	**$10,300.00**	**$8,700.00**	**$52,350.00**
Bomba de concreto DISA	$600.00			
Bomba de concreto UNICON	$600.00	$600.00	$600.00	$1,800.00
Camión HIAB	$500.00	$500.00	$500.00	$1,500.00
Cargador frontal Caterpillar	$2,300.00			$2,300.00
Cargador Frontal Volvo	$2,800.00			$2,800.00
Camión Mixer	$1,500.00	$1,500.00	$1,500.00	$4,500.00
Chancadora	$3,000.00			$3,000.00
Compresora 1066 CFM (GyM)	$600.00			$600.00
Compresora 750 CFM	$2,400.00			$2,400.00
Planta concretera ELBA	$3,000.00			$3,000.00
Martillo hidráulico	$4,200.00	$4,600.00		$8,800.00
Retroescavadora	$2,300.00			$2,300.00
Scooptram	$3,850.00			$3,850.00
Silos	$3,000.00		$3,000.00	$6,000.00
Tractor	$2,800.00			$2,800.00
Truckdrill		$2,300.00	$2,300.00	$4,600.00
Bobcat		$800.00	$800.00	$1,600.00
Voquete de 15 m3	$500.00			$500.00
Herramientas, Consumibles y Equipos Menores	**$40,000.00**	**$15,000.00**	**$15,000.00**	**$70,000.00**
Varios	$40,000.00	$15,000.00	$15,000.00	$70,000.00
Subtotal	**$77,950.00**	**$28,300.00**	**$23,700.00**	**$129,350.00**
Personal				
Personal obrero	$1,534.68			$1,534.68
Personal staff	$350.00			$350.00
Subtotal	**$1,884.68**			**$1,884.68**
TOTAL MOVILIZACION (US$)				**$131,234.68**

GyM S.A.
LIMA - PERU
Client : ASEA BROWN BOVERI S. A.
Project : CAÑON DEL PATO EXPANSION

TABLA DE DESMOVILIZACION

DESCRIPCION	PRIMERA ETAPA	SEGUNDA ETAPA	TERCERA ETAPA	C. TOTAL (US$)
Equipos				
Area Electromecánica			**$7,000.00**	**$7,000.00**
Módulo hidráulico			$6,000.00	$6,000.00
Camión HIAB			$500.00	$500.00
Equipos de arenado			$500.00	$500.00
Cama baja				
Area Civil	**$16,900.00**	**$5,700.00**	**$16,900.00**	**$38,900.00**
Bomba de concreto DISA	$600.00			
Bomba de concreto UNICON	$600.00	$600.00	$600.00	$1,800.00
Camión HIAB		$500.00	$500.00	$1,000.00
Cargador frontal Caterpillar				
Cargador Frontal Volvo				
Camión Mixer	$1,500.00	$1,500.00	$1,500.00	$4,500.00
Chancadora				
Compresora 1066 CFM (GyM)			$600.00	$600.00
Compresora 750 CFM	$1,200.00			$1,200.00
Planta concretera ELBA			$3,000.00	$3,000.00
Martillo hidráulico	$4,000.00		$4,600.00	$8,600.00
Retroescavadora	$2,300.00			$2,300.00
Scooptram	$3,400.00			$3,400.00
Silos			$3,000.00	$3,000.00
Tractor	$2,800.00			$2,800.00
Truckdrill		$2,300.00	$2,300.00	$4,600.00
Bobcat		$800.00	$800.00	$1,600.00
Voquete de 15 m3	$500.00			$500.00
Herramientas, Consumibles y Equipos Menores			**$14,250.00**	**$14,250.00**
Varios			$14,250.00	$14,250.00
Subtotal	**$16,900.00**	**$5,700.00**	**$38,150.00**	**$60,150.00**
Personal				
Personal obrero				
Personal staff			$1,500.00	$1,500.00
Subtotal			**$1,500.00**	**$1,500.00**
TOTAL DESMOVILIZACION (US$)				**$61,650.00**

GyM S.A
LIMA - PERU
Client : ASEA BROWN BOVERI S. A.
Project : CAÑON DEL PATO EXPANSION

ALMACENES, OFICINAS Y CAMPAMENTOS

DESCRIPCIÓN	UND	CANT	MESES	C. UNIT. US$	C. TOTAL US$
Campamentos					
Habilitación y/o instalación					
Mano de obra	glb	1		$66,000.00	$66,000.00
Equipos	glb	1		$48,000.00	$48,000.00
Materiales	glb	1		$75,000.00	$75,000.00
Terceros	glb	1		$6,600.00	$6,600.00
Subtotal					**$195,600.00**
Mantenimiento					
Mano de Obra	unid.	2	18	$900.00	$32,400.00
Materiales	glb	1	18	$300.00	$5,400.00
Subtotal					**$37,800.00**
TOTAL US$					**$233,400.00**

GyM S.A.
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Project : CAÑON DEL PATO EXPANSION

TABLA DE IMPLEMENTOS DE SEGURIDAD

ITEM	DESCRIPCION	UND	CANT	C. UNIT. US$	C. TOTAL US$
1	ANTEOJOS BLANCOS PANORAMICOS NORSEG 1000 USA	UND	468	$4.25	$1,989.00
2	ANTEOJOS DE SEGURIDAD VERDES	PZA	28	$5.17	$144.76
3	ARNES PELVICO P/SOLDADOR	UND	29	$113.84	$3,301.40
4	AVISOS DE SEGURIDAD Y OTROS	GLB	1	$2,000.00	$2,000.00
5	BOTAS DE JEBE	PAR	265	$17.47	$4,630.19
6	BOTIN DE CUERO	PAR	1017	$18.66	$18,973.78
7	BOTIN DE CUERO CON PUNTA DE ACERO PARA ELCTRICISTA	PAR	5	$23.60	$118.00
8	CARETA PARA ESMERILAR	UND	26	$6.88	$178.88
9	CARETA PARA ESMERILAR CON CASCO	UND	12	$10.51	$126.17
10	CARETA PARA SOLDAR	UND	38	$11.84	$449.92
11	CARTUCHOS CONTRA POLVO	UND	100	$3.24	$324.00
12	CARTUCHOS CONTRA GASES TOXICOS	UND	15	$3.16	$47.40
13	CASACAS DE CUERO PARA SOLDADOR	UND	15	$14.00	$210.00
14	CASCO DE SEGURIDAD	UND	450	$3.31	$1,489.63
15	CHALECOS DE SOLDAR	UND	9	$12.40	$111.60
16	CINTA DE SEGURIDAD	KGS	206	$6.33	$1,304.12
17	CORREA DE SEGURIDAD ELECTRICISTA	UND	70	$43.84	$3,068.80
18	CORREA PORTALÁMPARA	UND	15	$5.55	$83.25
19	ESCARPINES DE CUERO P/SOLDADOR	PAR	25	$4.95	$123.75
20	EXTINTOR DE GAS CARBONICO	UND	5	$289.73	$1,448.64
21	EXTINTOR DE POLVO QUIMICO	UND	23	$68.29	$1,570.58
22	EXTINTOR PARA CAMIONETAS	UND	5	$25.86	$129.31
23	GUANTE DE SOLDADOR	PAR	303	$3.56	$1,078.68
24	GUANTE MIXTO DE NEOPRENE	PAR	186	$10.60	$1,971.60
25	GUANTES DE BADANA PARA SOLDADOR TIG	PAR	12	$3.98	$47.76
26	GUANTES DE CUERO	PAR	1354	$2.70	$3,655.80
27	GUANTES DE ELECTRICISTAS	PAR	31	$44.55	$1,381.05
28	GUANTES DE JEBE CALIBRE 35	PAR	36	$2.42	$87.27
29	GUANTES DE JEBE CALIBRE 60	PAR	168	$7.67	$1,288.56
30	GUANTES DE JEBE INDUSTRIAL	PAR	300	$1.50	$450.00
31	LENTES BUTON	UND	316	$12.50	$3,950.00
32	LENTES DE OXICORTE	UND	52	$3.71	$192.82
33	LENTES PANOR. DE SEGURIDAD UVEX TRANSPARENTES	UND	500	$3.75	$1,875.00
34	LENTES UVEX	UND	4	$9.57	$38.28
35	LINTERNA CHICA PARA CAMIONETA	UND	12	$3.45	$41.38
36	LINTERNA CON ASA	UND	9	$30.83	$277.48
37	MAMELUCO DE DENIN	UND	215	$13.62	$2,927.71
38	MANDIL DE CUERO P/SOLDADOR	UND	63	$6.90	$434.70
39	MANGA DE CUERO P/SOLDADOR	PAR	24	$6.89	$165.36
40	MASCARILLA DESCARTABLE	UND	3250	$0.50	$1,625.00
41	PANTALONES DE PVC	UND	50	$8.62	$431.03
42	POLOS	UND	200	$2.03	$406.90
43	REPUESTO PARA CARETA DE ESMERILAR	UND	50	$3.36	$168.00
44	REPUESTOS LENTES BUTON	UND	50	$6.62	$331.21
45	RESPIRADORES DE 1 VIA	UND	500	$7.39	$3,696.67
46	RESPIRADORES DE 2 VIAS PARA GASES TOXICOS	UND	7	$12.00	$84.00
47	ROPA DE PVC	UND	125	$16.79	$2,098.71
48	SIRENA DE 40W	UND	2	$19.00	$38.00
49	STICKERS	GLB	1	$100.00	$100.00
50	TAFILETES PARA CASCO DE SEGURIDAD, 4 PUNTAS	UND	50	$2.25	$112.50
51	TAPON DE OIDO C/ESTUCHE 3M 1210	UND	1658	$1.04	$1,719.11
52	TAPON DE OIDO TIPO COPA	UND	45	$19.11	$859.97
53	TRIANGULO DE SEGURIDAD	UND	12	$3.51	$42.12
54	UNIFORMES PERSONAL OBRERO	UND	984	$14.70	$14,464.80
55	UNIFORMES PERSONAL STAFF	UND	23	$14.60	$335.80
	TOTAL IMPLEMENTOS Y EQUIPOS DE SEGURIDAD				**$88,200.42**

GyM S.A.
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OBRAS CIVILES

	PARTIDAS	Unid.	METRADO	C. UNIT US$	C. TOTAL US$
20	**Obras Civiles**				
201	**Demolición y excavación**				
201001	Base de turbina y generador	m3	1,239.92	$148.47	$184,091.25
201002	Nicho de boquillas	m3	870.00	$246.80	$214,715.09
	Anclajes de fijación nicho de boquillas		432.00	$140.02	$60,488.64
201003	Nicho para bandeja de cables	m3	50.08	$148.47	$7,435.37
	Apuntalamientos de túnel, galería o similar	m2	36.00	$125.00	$4,500.00
201004	Cimentación de transformadores y muro contr	m3	253.00	$123.71	$31,298.93
201005	Canal de descarga	m3	170.00	$148.47	$25,239.89
201006	Túnel nuevo adicional	m	616.00	$93.49	$57,590.69
202	**Acero de Refuerzo**				
202001	Turbinas y generadores	Kg	105,807.00	$1.32	$139,665.24
202002	Nicho de boquillas	Kg	15,000.00	$1.32	$19,800.00
202003	Bandeja de Cables	Kg	1,325.00	$1.32	$1,749.00
202004	Banco de transformadores y muro contra ince	Kg	12,600.00	$0.73	$9,198.00
202005	Canal de descarga	Kg	3,000.00	$1.32	$3,960.00
202006	Túnel nuevo adicional	Kg	5,750.00	$0.70	$4,025.00
203	**Insertos Metálicos**				
203001	Turbinas y generadores	Kg	5,377.50	$3.73	$20,058.08
203002	Muros contra incendios	Kg	5,611.50	$1.00	$5,611.50
204	**Encofrado**				
204001	Turbinas y generadores	m2	222.00	$27.63	$6,133.86
204002	Nicho de boquillas	m2	1,092.00	$33.64	$36,734.88
204003	Bandeja de Cables	m2	90.00	$27.63	$2,486.70
204004	Banco de transformadores y muro contra ince	m2	546.00	$13.11	$7,158.06
204005	Canal de descarga	m2	445.00	$27.63	$12,295.35
204006	Túnel nuevo adicional	m	436.70	$30.17	$13,175.24
205	**Concreto**				
205001	Turbinas y generadores	m3	1,041.00	$172.98	$180,073.86
205002	Nicho de boquillas	m3	690.00	$218.12	$150,505.42
205003	Bandeja de Cables	m3	18.00	$105.75	$1,903.45
205004	Banco de transformadores y muro contra ince	m3	237.00	$168.06	$39,830.42
205005	Canal de descarga	m3	146.00	$175.92	$25,684.39
205006	Túnel nuevo adicional	m3	224.60	$162.89	$36,585.70
206	**Otros**				
206002	Shotcrete en bóveda y paredes	m2	17.00	$24.37	$414.23
206005	Tapón tipo BKH	u	2.00	$5,640.67	$11,281.33
206006	Vía de acceso al túnel1979	glb	1.00	$8,141.30	$8,141.30
206009	Acabados	glb	2.00	$28,500.00	$57,000.00
206010	Monitoreo, convergencia y control de celdas d	glb	1.00	$90,000.00	$90,000.00
43	**Instalaciones provisionales y mantenimiento**				
430001	Pantallas de protección	m2	1.00	$130,000.00	$130,000.00
	TOTAL				**$1,598,830.87**

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Project : CAÑON DEL PATO EXPANSION

AREA ELECTROMECANICA

	PARTIDAS	Unid.	METRADO	C. UNIT US$	C. TOTAL US$
	Area Electromecánica				
251	**Desmontaje**				
250001	Desmontaje	glb	6.00	$22,734.91	$136,409.45
252	**Montaje**				
250001	Turbina	u	12.00	$20,000.78	$240,009.38
250002	Válvula esférica	u	24.00	$1,097.09	$26,330.09
250003	Equipo contra incendios	u	6.00		
250004	Sistema de agua de refrigeración	u	6.00	$18,600.59	$111,603.53
250005	Tubería de presión	u	6.00	$15,485.83	$92,914.96
250006	Generador, HPCU	u	6.00	$16,098.48	$96,590.87
250007	Transformador de potencia	u	18.00	$3,873.91	$69,730.36
250008	Tableros de control	cjto	6.00	$9,469.82	$56,818.92
250009	Cables de energía, cables de control	cjto	6.00	$48,477.84	$290,867.01
250010	Sistema de puesta a tierra	cjto	1.00	$17,046.96	$17,046.96
250011	Instrumentación y automatización	cjto	6.00	$6,375.44	$38,252.66
250012	Pruebas y puesta en servicio	glb	1.00	$33,965.17	$33,965.17
250013	Transporte y acarreo de materiales	glb	1.00	$385,835.55	$385,835.55
250014	Instalación de interruptores en el patio de llav	u	3.00	$3,515.27	$10,545.80
	TOTAL				**$1,606,920.71**

GyM S.A.
LIMA - PERU
Client : ASEA BROWN BOVERI S. A.
Project : CAÑON DEL PATO EXPANSION

GASTOS GENERALES

ITEM	DESCRIPCION	CANT	MESES	C. UNIT. US$	LLSS	C. TOTAL US$
1.00	**Personal Técnico**					
	Gerente de Proyecto	1.00	17	$6,850.00	1.77	$205,662.35
	Gerencia de Obra	1.00	20	$2,100.00	1.77	$74,176.20
	Ing. Jefe de Montaje Eléctrico/Oficina Técnica	0.50	23	$2,200.00	1.77	$44,682.33
	Ing.Asistente Civil	1.00	18	$1,000.00	1.77	$31,789.80
	Ing. de Programación	1.00	19	$1,450.00	1.77	$48,656.06
	Jefe de Seguridad	1.00	19	$890.00	1.77	$29,864.75
	Ing. Control de Costos	1.00	19	$850.00	1.77	$28,522.52
	Ing. Asistente de oficina y campo	1.00	5	$850.00	1.77	$7,505.93
	Ing. Control de Calidad Mecánico Electricista	1.00	5	$1,900.00	1.77	$16,777.95
	Topógrafo	2.00	18	$1,700.00	1.00	$61,200.00
	Dibujante	1.00	15	$1,700.00	1.00	$25,500.00
	Enfermero**	2.00	17	$1,100.00	1.00	$37,400.00
	Asistente de Seguridad	1.00	16	$1,100.00	1.00	$17,600.00
	Personal de limpieza					
	Chofer ambulancia	1.00	18	$900.00	1.00	$16,200.00
	Personal Administrativo					
	Administrador	1.00	20	$1,100.00	1.77	$38,854.20
	Coordinador en Lima*	0.33	12	$1,300.00	1.77	$9,091.88
	Auxiliar Administrativo	1.00	18	$1,100.00	1.00	$19,800.00
	Auxiliar Administrativo					
	Secretaria Obra	1.00	25	$600.00	1.77	$26,491.50
	Secretaria GyM					
	Planillero	1.00	7	$900.00	1.77	$10,331.69
	Tareador	1.00	18	$1,100.00	1.00	$19,800.00
	Choferes					
	Sub Total Personal Tecnico Administrativo					**$769,907.14**
2.00	**Almacenes GyM SA**					
	Almacenero GyM S.A.	1.00	19	$1,700.00	1.00	$32,300.00
	Asistente de Almacén	2.00	19	$900.00	1.00	$34,200.00
	Sub Total Almacenes GyM SA					**$66,500.00**
3.00	**Almacenes Importaciones**					
	Almaceneros Material Importado	1.00	18	$1,700.00	1.00	$30,600.00
	Asistente de Almacén	4.00	12	$900.00	1.00	$43,200.00
	Sub Total Almacen Material Importado					**$73,800.00**
	Total Personal Técnico Administrativo					**$910,207.14**
4.00	**Gastos de Administración**					
	E q u i p o s					
	Camioneta	1.00		$10,000.00	1.00	$10,000.00
	Mantenimiento de camionetas	1.00	18	$200.00	1.00	$3,600.00
	Combuistible de camionetas	1.00	18	$300.00	1.00	$5,400.00
	Computadoras personales (10 unid.)	1.00	1	$19,000.00	1.00	$19,000.00
	Impresoras Golpe (3 unid.)	3.00	1	$300.00	1.00	$900.00
	Impresoras Inyeccion (3 unid.)	1.00	1	$1,200.00	1.00	$1,200.00
	Computadoras portátiles	2.00	1	$3,500.00	1.00	$7,000.00
	Impresoras Laser	1.00	1	$1,500.00	1.00	$1,500.00
	Software, licencias	1.00	1	$21,000.00	1.00	$21,000.00
	Fotocopiadora	1.00	1	$4,000.00	1.00	$4,000.00
	Friobar MO4BL MABE	1.00	1	$500.00	1.00	$500.00
	Camara Digital	1.00	1	$800.00	1.00	$800.00
	Aire Acondicionado T/ventana Mod XCC123D Carrier 12,000 BTU/h	5.00	1	$500.00	1.00	$2,500.00
	Tv 14"Samsung	5.00	1	$200.00	1.00	$1,000.00
	VHS VT - k85 Marca Samsung	3.00	1	$300.00	1.00	$900.00
	Ambulancia	1.00	17	$1,000.00	1.00	$17,000.00
	Dispensador de agua	1.00	1	$320.00	1.00	$320.00
	Anilladora	1.00	1	$350.00	1.00	$350.00
	Camara de video					
	Subtotal Equipos					**$96,970.00**
5.00	**Gastos Diversos**					

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LIMA - PERU
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GASTOS GENERALES

ITEM	DESCRIPCION	CANT	MESES	C. UNIT. US$	LLSS	C. TOTAL US$
	Agua mineral	1.00	20	$150.00	1.00	$3,000.00
	Telefono-Facsimil	1.00	20	$3,500.00	1.00	$70,000.00
	Utiles de Oficina	1.00	19	$500.00	1.00	$9,500.00
	Fotocopias	1.00	18	$500.00	1.00	$9,000.00
	Oficinas	1.00	20	$90.00	1.00	$1,800.00
	Elaboración de Oferta	1.00	1	$20,000.00	1.00	$20,000.00
	Gastos de Alimentación y Vivienda Staff	1.00	19	$2,500.00	1.00	$47,500.00
	Gastos de Representación	1.00	18	$500.00	1.00	$9,000.00
	Viaje a Denver (A. Olavide, L. Vinatea)					
	Subtotal Varios					**$169,800.00**
	Total gastos de Admistración					**$266,770.00**
	Mantenimiento de equipos					**$15,000.00**
TOTAL GASTOS GENERALES		**$1,191,977.14**				

ANEXO C

RESULTADO FINAL DE LA OBRA

GyM S.A.
MA - PERU

Client : ASEA BROWN BOVERI S. A.
Project : CAÑON DEL PATO EXPANSION

RESULTADO FINAL DE OBRA

ITEM	DESCRIPCION	P. VENTA US$	COSTO US$	MARGEN US$	MARGEN %
	Alcances del Presupuesto Meta				
01	Alcances del contrato	$3,909,610.00	$5,796,130.96	($1,886,520.96)	-48.25%
02	Ampliación del foso del generador	$49,290.00	$32,423.62	$16,866.38	34.22%
03	Excavación adicional para lozalizar los HPCU y los acumuladores	$61,620.00	$50,314.62	$11,305.38	18.35%
04	Ampliación del foso de la turbina	$76,500.00	$50,317.44	$26,182.56	34.23%
SUB TOTAL CONTRACTUAL (US$)		**$4,097,020.00**	**$5,929,186.64**	**($1,832,166.64)**	**-44.72%**
	Trabajos Adicionales				
01	Desarrollo de la ingenieria básica de los equipos	$23,000.00	$24,087.00	($1,087.00)	-4.73%
02	Estudio del sistema de refrigeración y ventilación de la casa d máquinas	$38,560.00	$38,560.00		
03	Estudio de la separación existente entre los generados y las turbina existentes	$7,278.00	$7,278.00		
04	Búsqueda de información adicional para las instalaciones existentes	$10,075.00	$10,075.00		
05	Estudio geotécnico desarrollado por GMI	$30,000.00	$49,081.00	($19,081.00)	-63.60%
06	Diseño y suministro de los anclajes para las turbinas	$150,000.00	$192,820.00	($42,820.00)	-28.55%
07	Ubicación y reubicación de los transformadores nuevos y existentes	$21,280.00	$6,477.00	$14,803.00	69.56%
08	Retraso de la información suministrada por ABB/Kavaemer	$29,500.00	$19,875.00	$9,625.00	32.63%
09	Cambios en el diseño de la distribución de la sala de baterias	$5,850.00	$4,050.00	$1,800.00	30.77%
10	Diferencias en los volúmenes de excavación en la base de turbinas generadores	$400,000.00	$561,563.71	($161,563.71)	-40.39%
11	Desarrollo de la ingenieria para el patio de llaves	$5,750.00	$3,966.00	$1,784.00	31.03%
12	Estudio para confimar el uso de los soportes y bandejas existentes e la galeria de cables	$4,800.00	$3,791.00	$1,009.00	21.02%
13	Ampliación del túnel de descarga 1979	$897,425.78	$490,000.00	$407,425.78	45.40%
14	Desarrollo de la ingenieria para los servicios eléctricos auxiliares	$11,650.00	$7,653.00	$3,997.00	34.31%
15	Suministro del anillo de transición para la tubería de presión		$27,320.00	($27,320.00)	
16	Suministro de tuberias y accesorios para el sistema de agua d enfriamiento	$18,345.00	$7,782.27	$10,562.73	57.58%
17	Suministro de tuberias y accesorios para el sistema de enfriamient de aceite del generador	$11,487.00	$4,934.36	$6,552.64	57.04%
18	Montaje de la sala de baterias	$8,918.00	$7,400.00	$1,518.00	17.02%
19	Maniobras adicionales debido a las dimensiones del generador	$5,000.00		$5,000.00	100.00%
20	Evaluación de la reactancia de los cables de 13.8 KV	$6,486.00	$4,989.00	$1,497.00	23.08%
21	Suministro de operador de puente grúa	$81,567.00	$50,000.00	$31,567.00	38.70%
SUB TOTAL ADICIONALES (US$)		**$1,766,971.78**	**$1,521,702.34**	**$245,269.44**	**13.88%**
TOTAL (US$)		**$5,863,991.78**	**$7,450,888.98**	**($1,586,897.20)**	**-27.06%**

GyM S.A.
LIMA - PERU
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Project : CAÑON DEL PATO EXPANSION

RESULTADO FINAL DE OBRA SIN TRABAJOS ADICIONALES

	PARTIDAS	UND	CANT	C. UNIT US$	C. TOTAL US$
05	**Supervisión Directa de Obra**				
050001	Supervisión Directa de Obra	glb	1.00	$676,950.18	$676,950.18
10	**Movilización y desmovilización**				
100001	Movilización y desmovilización	glb	1.00	$155,934.68	$155,934.68
100002	Campamentos	glb	1.00	$233,400.00	$233,400.00
12	**Ingeniería del Proyecto**				
120001	Ingeniería del Proyecto (GMI)	glb	1.00	$250,000.00	$250,000.00
15	**Seguridad**				
150001	Implementos y equipos de seguridad	glb	1.00	$78,577.31	$78,577.31
150002	Medicinas	glb	1.00	$10,000.00	$10,000.00
20	**Obras Civiles**				
200001	Obras civiles	glb	1.00	$1,573,830.87	$1,573,830.87
25	**Obras Mecánico Eléctricas**				
250001	Obras mecánico eléctricas	glb	1.00	$1,518,870.87	$1,518,870.87
50	**Gastos Generales**				
500001	Gastos Generales	glb	1.00	$1,201,622.74	$1,201,622.74
55	**Gestión Extraordinaria**				
552000	Egresos Financieros	glb	1.00	$230,000.00	$230,000.00
COSTO TOTAL (US$)				**$5,929,186.64**	
PRECIO DE VENTA (US$)				**$4,097,020.00**	
MARGEN (US$)				**-$1,832,166.64**	
MARGEN (% PRECIO DE VENTA)				**-44.72%**	

GyM S.A.
LIMA - PERU
Client : ASEA BROWN BOVERI S. A.
Project : CAÑON DEL PATO EXPANSION

SUPERVISION DIRECTA DE OBRA

ITEM	SUPERVISION DIRECTA	CANT	MESES	C. UNIT. US$	LLSS 76.61%	C. TOTAL US$
1.00	**Area Mecánica Eléctrica**					
	Ing. Jefe de Montaje Mecánico	1.00	16.00	$1,850.00	$1,417.29	$52,276.56
	Ing. Jefe de Montaje Eléctrico	1.00	12.00	$2,200.00	$1,685.42	$46,625.04
	Ing. Asistente Area Civil	1.00	6.00	$800.00	612.88	$8,477.28
	Supervisor de Obras Mecánicas	1.00	18.00	$2,400.00	$1,838.64	$76,295.52
	Supervisor de Soldadura	1.00	18.00	$1,350.00		$24,300.00
	Supervisor de Obras Eléctricas	1.00	18.00	$1,100.00	$842.71	$34,968.78
	Supervisor de Instrumentación	1.00	12.00	$1,150.00	$881.02	$24,372.18
	Supervisión de soldadura (ensayos no destructivos)	1.00		$12,500.00		$12,500.00
	Calificación de soldadores	1.00		$1,050.00		$1,050.00
	Choferes	2.00	15.00	$1,100.00		$33,000.00
	Subcontrata montaje	1.00		$1,800.00		$1,800.00
2.00	**Area Civil**					
	Ing. Jefe de Montaje Civil	1.00	12.00	$3,300.00	$2,528.13	$69,937.56
	Ing. Jefe de Montaje Civil	1.00	13.00	$2,150.00	$1,647.12	$49,362.50
	Asesoria de Concreto	1.00			$4,200.00	$4,200.00
	Supervisor de Obras Civiles	1.00	16.00	$1,300.00		$20,800.00
	Supervisor de Obras Civiles	1.00	8.00	$1,200.00	$919.32	$16,954.56
	Supervisor de Obras Civiles	1.00	13.00	$1,650.00		$21,450.00
	Supervisor de Voladuras	1.00	9.00	$6,000.00		$54,000.00
	Laboratorista	1.00	16.00	$800.00	$612.88	$22,606.08
	Quimica Sol	1.00	5.00	$3,000.00		$15,000.00
	Guardián polvorín	1.00		$1,000.00		$1,000.00
	Choferes	2.00	15.00	$1,100.00		$33,000.00
	Ensayos de laboratorio SENCICO	1.00		$258.00		$258.00
	Asesoria de SVS	1.00		$2,000.00		$2,000.00
	Provisión aumento sueldos					
3.00	**Equipos**					
	Camionetas	2.00		$5,000.00		$10,000.00
	Gasolina Camionetas	2.00	18.00	$550.00		$19,800.00
	Mantenimiento de camionetas	3.00	18.00	$240.00		$12,960.00
	Radios Portatiles SP-50 2chs c/cargador y bateria	6.00		$203.77		$1,222.62
	Radio Base-Movil Motorola SM 50 2CH-40 W	2.00		$266.75		$533.50
	Radios Motorola	16.00		$350.00		$5,600.00
	Radio Largo Alcance	1.00		$600.00		$600.00

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TABLA DE MOVILIZACION

DESCRIPCION	PRIMERA ETAPA	SEGUNDA ETAPA	TERCERA ETAPA	C. TOTAL (US$)
Equipos				
Area Electromecánica	**$4,000.00**	**$3,000.00**		**$7,000.00**
Módulo hidráulico	$3,000.00	$3,000.00		$6,000.00
Camión HIAB	$500.00			$500.00
Equipos de arenado	$500.00			$500.00
Cama baja				
Area Civil	**$33,950.00**	**$10,300.00**	**$8,700.00**	**$52,350.00**
Bomba de concreto DISA	$600.00			
Bomba de concreto UNICON	$600.00	$600.00	$600.00	$1,800.00
Camión HIAB	$500.00	$500.00	$500.00	$1,500.00
Cargador frontal Caterpillar	$2,300.00			$2,300.00
Cargador Frontal Volvo	$2,800.00			$2,800.00
Camión Mixer	$1,500.00	$1,500.00	$1,500.00	$4,500.00
Chancadora	$3,000.00			$3,000.00
Compresora 1066 CFM (GyM)	$600.00			$600.00
Compresora 750 CFM	$2,400.00			$2,400.00
Planta concretera ELBA	$3,000.00			$3,000.00
Martillo hidráulico	$4,200.00	$4,600.00		$8,800.00
Retroescavadora	$2,300.00			$2,300.00
Scooptram	$3,850.00			$3,850.00
Silos	$3,000.00		$3,000.00	$6,000.00
Tractor	$2,800.00			$2,800.00
Truckdrill		$2,300.00	$2,300.00	$4,600.00
Bobcat		$800.00	$800.00	$1,600.00
Voquete de 15 m3	$500.00			$500.00
Herramientas, Consumibles y Equipos Menores	**$40,000.00**	**$2,500.00**	**$2,500.00**	**$45,000.00**
Varios	$40,000.00	$2,500.00	$2,500.00	$45,000.00
Subtotal	**$77,950.00**	**$15,800.00**	**$11,200.00**	**$104,350.00**
Personal				
Personal obrero	$1,534.68			$1,534.68
Personal staff	$350.00			$350.00
Subtotal	**$1,884.68**			**$1,884.68**
TOTAL MOVILIZACION (US$)				**$106,234.68**

GyM S.A.
LIMA - PERU
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Project : CAÑON DEL PATO EXPANSION

TABLA DE DESMOVILIZACION

DESCRIPCION	PRIMERA ETAPA	SEGUNDA ETAPA	TERCERA ETAPA	C. TOTAL (US$)
Equipos				
Area Electromecánica			**$7,000.00**	**$7,000.00**
Módulo hidráulico			$6,000.00	$6,000.00
Camión HIAB			$500.00	$500.00
Equipos de arenado			$500.00	$500.00
Cama baja				
Area Civil	**$16,900.00**	**$5,400.00**	**$16,000.00**	**$37,700.00**
Bomba de concreto DISA	$600.00			
Bomba de concreto UNICON	$600.00	$600.00	$600.00	$1,800.00
Camión HIAB		$500.00	$500.00	$1,000.00
Cargador frontal Caterpillar				
Cargador Frontal Volvo				
Camión Mixer	$1,500.00	$1,500.00	$1,500.00	$4,500.00
Chancadora				
Compresora 1066 CFM (GyM)			$600.00	$600.00
Compresora 750 CFM	$1,200.00			$1,200.00
Planta concretera ELBA			$3,000.00	$3,000.00
Martillo hidráulico	$4,000.00		$4,000.00	$8,000.00
Retroescavadora	$2,300.00			$2,300.00
Scooptram	$3,400.00			$3,400.00
Silos			$3,000.00	$3,000.00
Tractor	$2,800.00			$2,800.00
Truckdrill		$2,000.00	$2,000.00	$4,000.00
Bobcat		$800.00	$800.00	$1,600.00
Voquete de 15 m3	$500.00			$500.00
Herramientas, Consumibles y Equipos Menores			**$5,000.00**	**$5,000.00**
Varios			$5,000.00	$5,000.00
Subtotal	**$16,900.00**	**$5,400.00**	**$28,000.00**	**$49,700.00**
Personal				
Personal obrero				
Personal staff				
Subtotal				
TOTAL DESMOVILIZACION (US$)				**$49,700.00**

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ALMACENES, OFICINAS Y CAMPAMENTOS

DESCRIPCIÓN	UND	CANT	MESES	C. UNIT. US$	C. TOTAL US$
Campamentos					
Habilitación y/o instalación					
Mano de obra	glb	1		$66,000.00	$66,000.00
Equipos	glb	1		$48,000.00	$48,000.00
Materiales	glb	1		$75,000.00	$75,000.00
Terceros	glb	1		$6,600.00	$6,600.00
Subtotal					**$195,600.00**
Mantenimiento					
Mano de Obra	unid.	2	18	$900.00	$32,400.00
Materiales	glb	1	18	$300.00	$5,400.00
Subtotal					**$37,800.00**
TOTAL US$					**$233,400.00**

GyM S.A.
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Project : CAÑON DEL PATO EXPANSION

TABLA DE IMPLEMENTOS DE SEGURIDAD

ITEM	DESCRIPCION	UND	CANT	C. UNIT. US$	C. TOTAL US$
1	ANTEOJOS BLANCOS PANORAMICOS NORSEG 1000 USA	UND	417	$4.25	$1,772.25
2	ANTEOJOS DE SEGURIDAD VERDES	PZA	25	$5.17	$129.25
3	ARNES PELVICO P/SOLDADOR	UND	26	$113.84	$2,959.88
4	AVISOS DE SEGURIDAD Y OTROS	GLB	1	$2,000.00	$2,000.00
5	BOTAS DE JEBE	PAR	236	$17.47	$4,123.49
6	BOTIN DE CUERO	PAR	905	$18.66	$16,884.24
7	BOTIN DE CUERO CON PUNTA DE ACERO PARA ELCTRICISTA	PAR	4	$23.60	$94.40
8	CARETA PARA ESMERILAR	UND	23	$6.88	$158.24
9	CARETA PARA ESMERILAR CON CASCO	UND	11	$10.51	$115.65
10	CARETA PARA SOLDAR	UND	34	$11.84	$402.56
11	CARTUCHOS CONTRA POLVO	UND	89	$3.24	$288.36
12	CARTUCHOS CONTRA GASES TOXICOS	UND	13	$3.16	$41.08
13	CASACAS DE CUERO PARA SOLDADOR	UND	13	$14.00	$182.00
14	CASCO DE SEGURIDAD	UND	401	$3.31	$1,327.42
15	CHALECOS DE SOLDAR	UND	8	$12.40	$99.20
16	CINTA DE SEGURIDAD	KGS	183	$6.33	$1,157.95
17	CORREA DE SEGURIDAD ELECTRICISTA	UND	62	$43.84	$2,718.08
18	CORREA PORTALÁMPARA	UND	13	$5.55	$72.15
19	ESCARPINES DE CUERO P/SOLDADOR	PAR	22	$4.95	$108.90
20	EXTINTOR DE GAS CARBONICO	UND	4	$289.73	$1,158.91
21	EXTINTOR DE POLVO QUIMICO	UND	20	$68.29	$1,365.72
22	EXTINTOR PARA CAMIONETAS	UND	4	$25.86	$103.45
23	GUANTE DE SOLDADOR	PAR	270	$3.56	$961.20
24	GUANTE MIXTO DE NEOPRENE	PAR	166	$10.60	$1,759.60
25	GUANTES DE BADANA PARA SOLDADOR TIG	PAR	11	$3.98	$43.78
26	GUANTES DE CUERO	PAR	1205	$2.70	$3,253.50
27	GUANTES DE ELECTRICISTAS	PAR	28	$44.55	$1,247.40
28	GUANTES DE JEBE CALIBRE 35	PAR	32	$2.42	$77.57
29	GUANTES DE JEBE CALIBRE 60	PAR	150	$7.67	$1,150.50
30	GUANTES DE JEBE INDUSTRIAL	PAR	267	$1.50	$400.50
31	LENTES BUTON	UND	281	$12.50	$3,512.50
32	LENTES DE OXICORTE	UND	46	$3.71	$170.57
33	LENTES PANOR. DE SEGURIDAD UVEX TRANSPARENTES	UND	445	$3.75	$1,668.75
34	LENTES UVEX	UND	4	$9.57	$38.28
35	LINTERNA CHICA PARA CAMIONETA	UND	11	$3.45	$37.93
36	LINTERNA CON ASA	UND	8	$30.83	$246.65
37	MAMELUCO DE DENIN	UND	191	$13.62	$2,600.89
38	MANDIL DE CUERO P/SOLDADOR	UND	56	$6.90	$386.40
39	MANGA DE CUERO P/SOLDADOR	PAR	21	$6.89	$144.69
40	MASCARILLA DESCARTABLE	UND	2893	$0.50	$1,446.50
41	PANTALONES DE PVC	UND	45	$8.62	$387.93
42	POLOS	UND	178	$2.03	$362.14
43	REPUESTO PARA CARETA DE ESMERILAR	UND	45	$3.36	$151.20
44	REPUESTOS LENTES BUTON	UND	45	$6.62	$298.09
45	RESPIRADORES DE 1 VIA	UND	445	$7.39	$3,290.03
46	RESPIRADORES DE 2 VIAS PARA GASES TOXICOS	UND	6	$12.00	$72.00
47	ROPA DE PVC	UND	111	$16.79	$1,863.65
48	SIRENA DE 40W	UND	2	$19.00	$38.00
49	STICKERS	GLB	1	$100.00	$100.00
50	TAFILETES PARA CASCO DE SEGURIDAD, 4 PUNTAS	UND	45	$2.25	$101.25
51	TAPON DE OIDO C/ESTUCHE 3M 1210	UND	1476	$1.04	$1,530.40
52	TAPON DE OIDO TIPO COPA	UND	40	$19.11	$764.41
53	TRIANGULO DE SEGURIDAD	UND	11	$3.51	$38.61
54	UNIFORMES PERSONAL OBRERO	UND	876	$14.70	$12,877.20
55	UNIFORMES PERSONAL STAFF	UND	20	$14.60	$292.00
	TOTAL IMPLEMENTOS Y EQUIPOS DE SEGURIDAD				**$78,577.31**

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OBRAS CIVILES

	PARTIDAS	Unid.	METRADO	C. UNIT US$	C. TOTAL US$
20	**Obras Civiles**				
201	**Demolición y excavación**				
201001	Base de turbina y generador	m3	1,239.92	$148.47	$184,091.25
201002	Nicho de boquillas	m3	870.00	$246.80	$214,715.09
	Anclajes de fijación nicho de boquillas		432.00	$140.02	$60,488.64
201003	Nicho para bandeja de cables	m3	50.08	$148.47	$7,435.37
	Apuntalamientos de túnel, galería o similar	m2	36.00	$125.00	$4,500.00
201004	Cimentación de transformadores y muro contra i	m3	253.00	$123.71	$31,298.93
201005	Canal de descarga	m3	170.00	$148.47	$25,239.89
201006	Túnel nuevo adicional	m	616.00	$93.49	$57,590.69
202	**Acero de Refuerzo**				
202001	Turbinas y generadores	Kg	105,807.00	$1.32	$139,665.24
202002	Nicho de boquillas	Kg	15,000.00	$1.32	$19,800.00
202003	Bandeja de Cables	Kg	1,325.00	$1.32	$1,749.00
202004	Banco de transformadores y muro contra incendi	Kg	12,600.00	$0.73	$9,198.00
202005	Canal de descarga	Kg	3,000.00	$1.32	$3,960.00
202006	Túnel nuevo adicional	Kg	5,750.00	$0.70	$4,025.00
203	**Insertos Metálicos**				
203001	Turbinas y generadores	Kg	5,377.50	$3.73	$20,058.08
203002	Muros contra incendios	Kg	5,611.50	$1.00	$5,611.50
204	**Encofrado**				
204001	Turbinas y generadores	m2	222.00	$27.63	$6,133.86
204002	Nicho de boquillas	m2	1,092.00	$33.64	$36,734.88
204003	Bandeja de Cables	m2	90.00	$27.63	$2,486.70
204004	Banco de transformadores y muro contra incendi	m2	546.00	$13.11	$7,158.06
204005	Canal de descarga	m2	445.00	$27.63	$12,295.35
204006	Túnel nuevo adicional	m	436.70	$30.17	$13,175.24
205	**Concreto**				
205001	Turbinas y generadores	m3	1,041.00	$172.98	$180,073.86
205002	Nicho de boquillas	m3	690.00	$218.12	$150,505.42
205003	Bandeja de Cables	m3	18.00	$105.75	$1,903.45
205004	Banco de transformadores y muro contra incendi	m3	237.00	$168.06	$39,830.42
205005	Canal de descarga	m3	146.00	$175.92	$25,684.39
205006	Túnel nuevo adicional	m3	224.60	$162.89	$36,585.70
206	**Otros**				
206002	Shotcrete en bóveda y paredes	m2	17.00	$24.37	$414.23
206005	Tapón tipo BKH	u	2.00	$5,640.67	$11,281.33
206006	Vía de acceso al túnel1979	glb	1.00	$8,141.30	$8,141.30
206009	Acabados	glb	2.00	$16,000.00	$32,000.00
206010	Monitoreo, convergencia y control de celdas de a	glb	1.00	$90,000.00	$90,000.00
43	**Instalaciones provisionales y mantenimiento**				
430001	Pantallas de protección	m2	1.00	$130,000.00	$130,000.00
	TOTAL				**$1,573,830.87**

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AREA ELECTROMECANICA

	PARTIDAS	Unid.	METRADO	C. UNIT US$	C. TOTAL US$
	Area Electromecánica				
251	**Desmontaje**				
250001	Desmontaje	glb	6.00	$24,341.71	$146,050.25
252	**Montaje**				
250001	Turbina	u	12.00	$19,808.48	$237,701.78
250002	Válvula esférica	u	24.00	$1,086.54	$26,076.94
250003	Equipo contra incendios	u	6.00		
250004	Sistema de agua de refrigeración	u	6.00	$18,421.75	$110,530.50
250005	Tubería de presión	u	6.00	$15,336.94	$92,021.61
250006	Generador, HPCU	u	6.00	$15,943.70	$95,662.18
250007	Transformador de potencia	u	18.00	$3,086.40	$55,555.14
250008	Tableros de control	cjto	6.00	$9,378.77	$56,272.62
250009	Cables de energía, cables de control	cjto	6.00	$48,011.74	$288,070.43
250010	Sistema de puesta a tierra	cjto	1.00	$16,883.06	$16,883.06
250011	Instrumentación y automatización	cjto	6.00	$6,314.15	$37,884.88
250012	Pruebas y puesta en servicio	glb	1.00	$31,256.65	$31,256.65
250013	Transporte y acarreo de materiales	glb	1.00	$313,971.35	$313,971.35
250014	Instalación de interruptores en el patio de llaves	u	3.00	$3,644.49	$10,933.46
	TOTAL			**$1,518,870.87**	

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GASTOS GENERALES

ITEM	DESCRIPCION	CANT	MESES	C. UNIT. US$	LLSS	C. TOTAL US$
1.00	**Personal Técnico**					
	Gerente de Proyecto	1.00	17	$6,200.00	1.77	$186,146.94
	Gerencia de Obra	1.00	18	$2,100.00	1.77	$66,758.58
	Ing. Jefe de Oficina Técnica	1.00	15	$2,000.00	1.77	$52,983.00
	Ing.Asistente Civil	1.00	17	$1,000.00	1.77	$30,023.70
	Ing. de Programación	1.00	17	$1,450.00	1.77	$43,534.37
	Jefe de Seguridad	1.00	17	$1,100.00	1.77	$33,026.07
	Ing. Control de Costos	1.00	18	$850.00	1.77	$27,021.33
	Ing. Asistente de oficina y campo	1.00	5	$850.00	1.77	$7,505.93
	Ing. Control de Calidad Mecánico Electricista	1.00	4	$1,900.00	1.77	$13,422.36
	Topógrafo	2.00	11	$1,700.00	1.00	$37,400.00
	Dibujante	1.00	15	$1,700.00	1.00	$25,500.00
	Enfermero	2.00	13	$1,100.00	1.00	$28,600.00
	Asistente de Seguridad	1.00	18	$1,100.00	1.00	$19,800.00
	Personal de limpieza	1.00	12	$900.00	1.00	$10,800.00
	Chofer ambulancia	1.00	18	$900.00	1.00	$16,200.00
	Personal Administrativo					
	Administrador	1.00	20	$1,100.00	1.77	$38,854.20
	Coordinador en Lima	0.50	17	$1,300.00	1.77	$19,515.41
	Auxiliar Administrativo	2.00	11	$1,100.00	1.00	$24,200.00
	Auxiliar Administrativo					
	Secretaria Obra	1.00	18	$450.00	1.77	$14,305.41
	Secretaria GyM	1.00	3	$800.00	1.77	$4,248.00
	Planillero	1.00	5	$900.00	1.77	$7,947.45
	Tareador	1.00	14	$1,100.00	1.00	$15,400.00
	Choferes	1.00	10	$1,100.00	1.00	$11,000.00
	Sub Total Personal Tecnico Administrativo					**$734,192.74**
2.00	**Almacenes GyM SA**					
	Almacenero GyM S.A.	1.00	16	$1,700.00	1.00	$27,200.00
	Asistente de Almacén	2.00	13	$900.00	1.00	$23,400.00
	Sub Total Almacenes GyM SA					**$50,600.00**
3.00	**Almacenes Importaciones**					
	Almaceneros Material Importado	1.00	17	$1,700.00	1.00	$28,900.00
	Asistente de Almacén	2.00	13	$900.00	1.00	$23,400.00
	Sub Total Almacen Material Importado					**$52,300.00**
	Total Personal Técnico Administrativo					**$837,092.74**
4.00	**Gastos de Administración**					
	E q u i p o s					
	Camioneta	1.00		$5,000.00	1.00	$5,000.00
	Mantenimiento de camionetas	1.00	18	$300.00	1.00	$5,400.00
	Combuistible de camionetas	1.00	18	$500.00	1.00	$9,000.00
	Computadoras personales (10 unid.)	1.00	1	$15,000.00	1.00	$15,000.00
	Impresoras Golpe (3 unid.)	3.00	1	$250.00	1.00	$750.00
	Impresoras Inyeccion (3 unid.)	1.00	1	$1,000.00	1.00	$1,000.00
	Computadoras portátiles	2.00	1	$2,900.00	1.00	$5,800.00
	Impresoras Laser					
	Software, licencias	1.00	1	$17,500.00	1.00	$17,500.00
	Fotocopiadora	1.00	1	$3,500.00	1.00	$3,500.00
	Telefax	1.00	1	$680.00	1.00	$680.00
	Friobar MO4BL MABE	1.00	1	$200.00	1.00	$200.00
	Camara Digital	1.00	1	$550.00	1.00	$550.00
	Aire Acondicionado T/ventana Mod XCC123D Carrier 12,000 BTU/h	5.00	1	$330.00	1.00	$1,650.00
	Tv 14"Samsung	5.00	1	$120.00	1.00	$600.00
	VHS VT - k85 Marca Samsung	3.00	1	$200.00	1.00	$600.00
	Ambulancia	1.00	18	$1,000.00	1.00	$18,000.00
	Dispensador de agua	1.00	1	$250.00	1.00	$250.00
	Anilladora	1.00	1	$300.00	1.00	$300.00
	Camara de video	1.00	1	$1,050.00	1.00	$1,050.00
	Subtotal Equipos					**$86,830.00**
5.00	**Gastos Diversos**					

GyM S.A.
LIMA - PERU
Client ASEA BROWN BOVERI S A
Project : CAÑON DEL PATO EXPANSION

GASTOS GENERALES

ITEM	DESCRIPCION	CANT	MESES	C. UNIT. US$	LLSS	C. TOTAL US$
	Agua mineral	1.00	20	$80.00	1.00	$1,600.00
	Telefono-Facsímil	1.00	20	$3,100.00	1.00	$62,000.00
	Utiles de Oficina	1.00	19	$3,300.00	1.00	$62,700.00
	Fotocopias	1.00	18	$700.00	1.00	$12,600.00
	Oficinas	1.00	20	$100.00	1.00	$2,000.00
	Elaboración de Oferta	1.00	1	$20,000.00	1.00	$20,000.00
	Movilidad (camionetas de Lima)	1.00	19	$500.00	1.00	$9,500.00
	Gastos de Alimentación y Vivienda Staff	1.00	19	$2,900.00	1.00	$55,100.00
	Gastos de Representación	1.00	18	$250.00	1.00	$4,500.00
	Viaje a Denver (A. Olavide, L. Vinatea)	1.00	18	$150.00	1.00	$2,700.00
	Pago planillas obreros, Renovación de contratos, Lic de funcionamiento	1.00	18	$200.00	1.00	$3,600.00
	Pago Sencico	1.00	18	$300.00	1.00	$5,400.00
	Gastos bancarios	1.00	12	$550.00	1.00	$6,600.00
	Compra y Uso frecuencia radios	1.00	18	$150.00	1.00	$2,700.00
	Seguro familiar y de accidentes	1.00	18	$550.00	1.00	$9,900.00
	Atención médica del personal	1.00	18	$100.00	1.00	$1,800.00

ANEXO D

FOTOS DEL PROCESO CONSTRUCTIVO

VISTA GENERAL

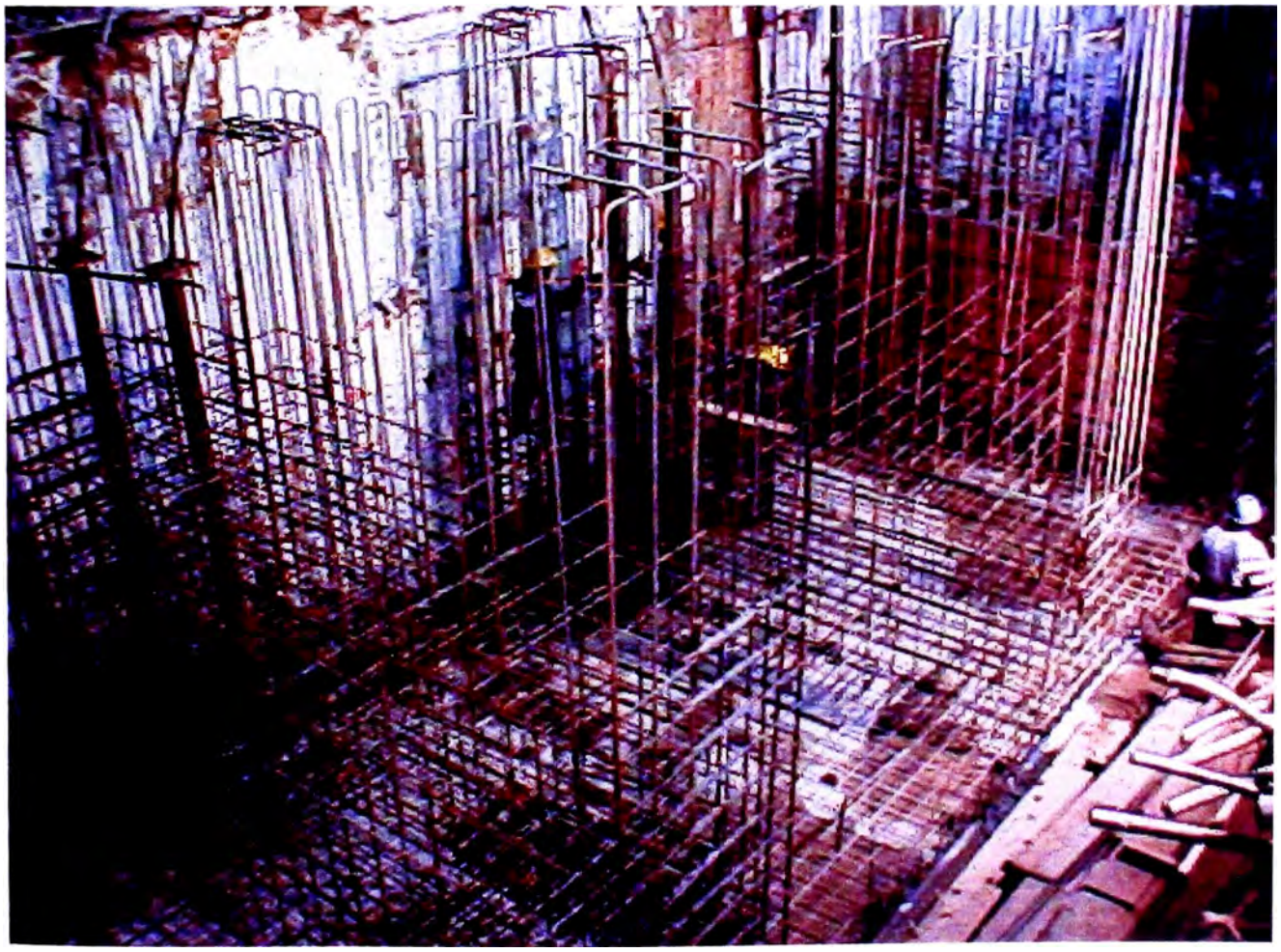
DEL

CAÑON DEL PATO

ARREGLO GENERAL DE LA SALA DE MAQUINAS ANTES DE LA AMPLIACION

DEMOLICIÓN EN LOS NICHOS DE BOQUILLAS CON MARTILLOS HIDRAULICOS

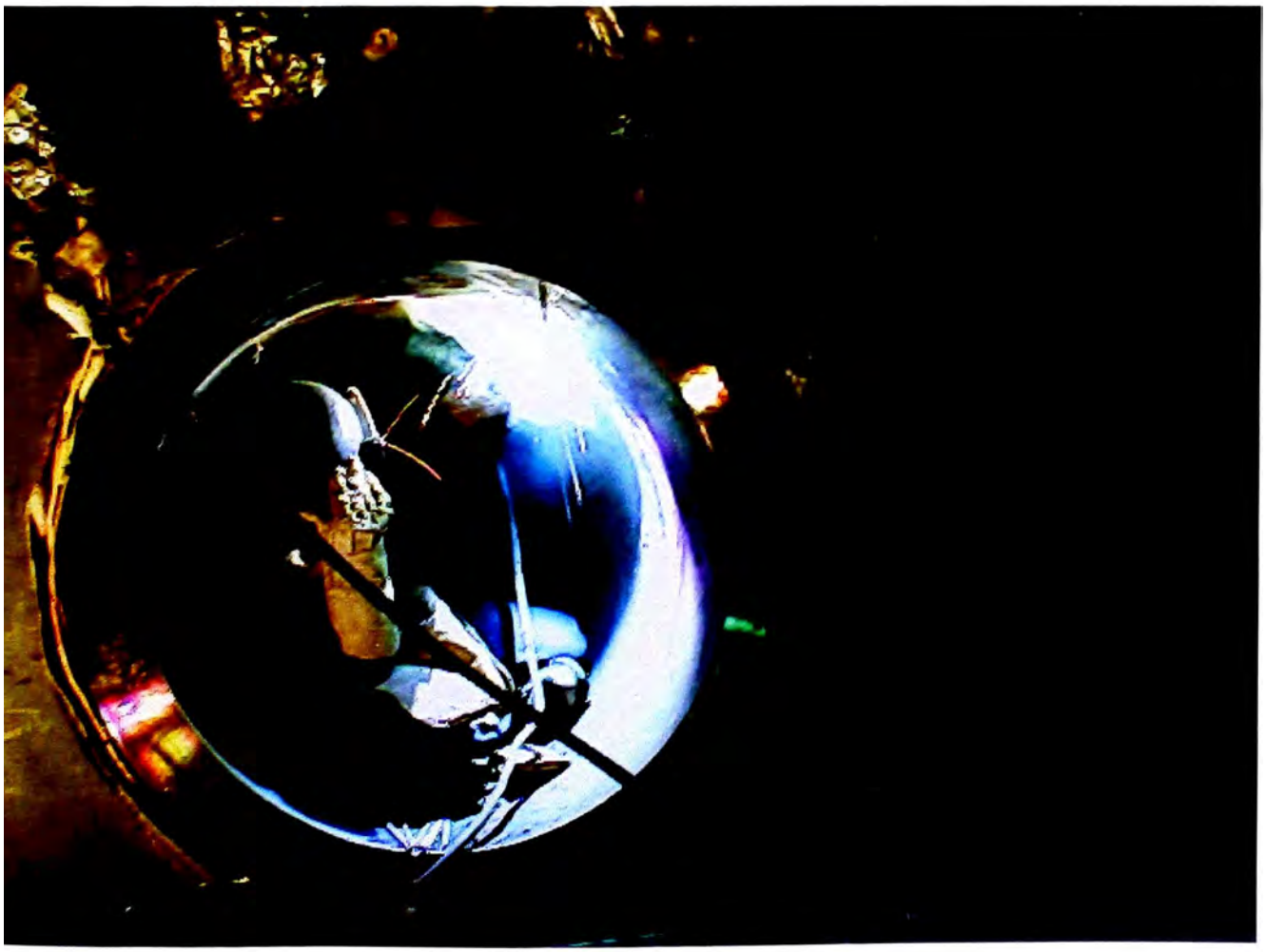
ARMADURA DE REFUERZO PARA LAS CIMENTACIONES DE LAS TURBINAS Y GENERADORES



INSTALACION DEL PENSTOCK RING

DE LA TUBERIA DE PRESION

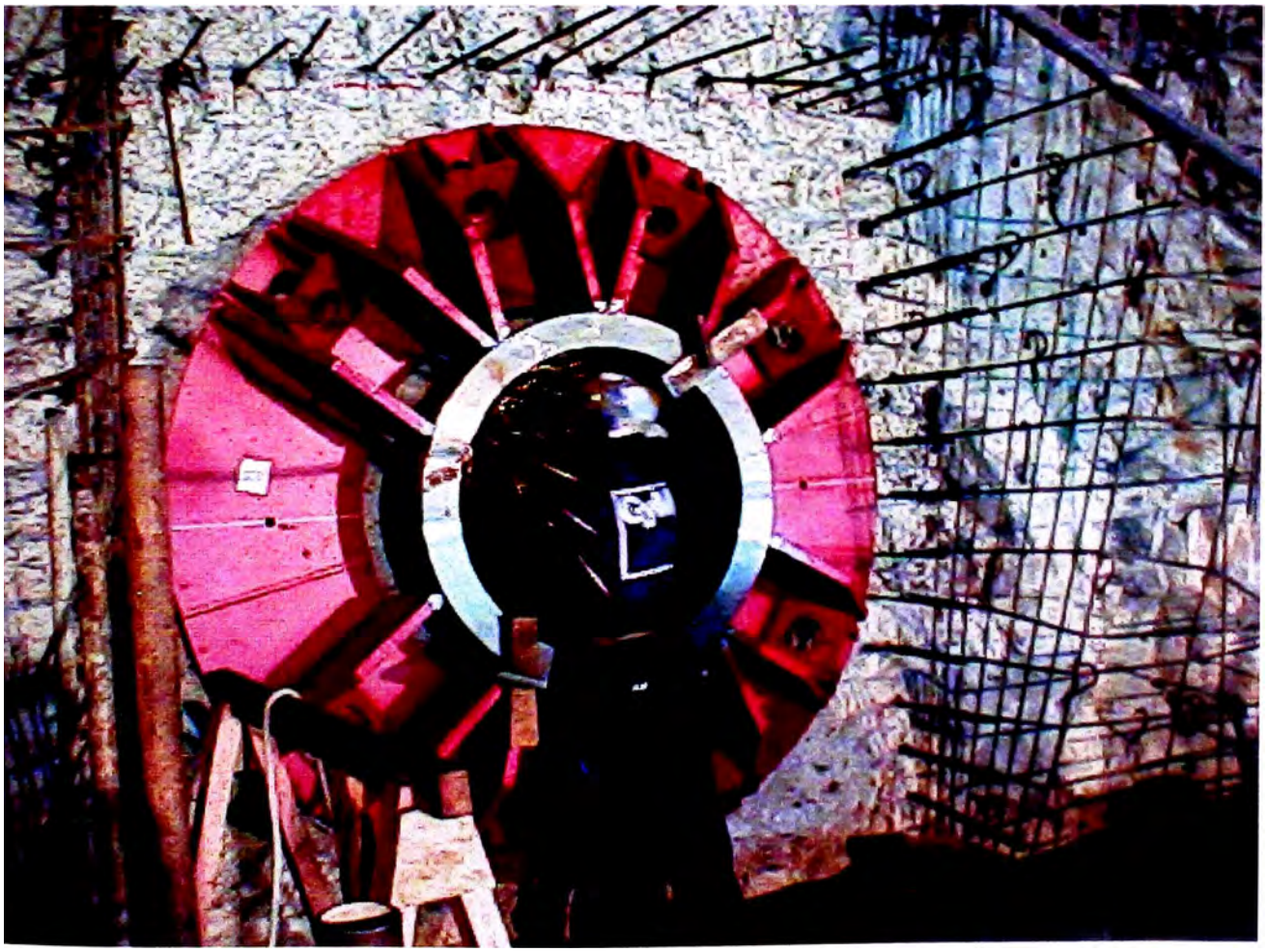
1/2



INSTALACION DEL PENSTOCK RING

DE LA TUBERIA DE PRESION

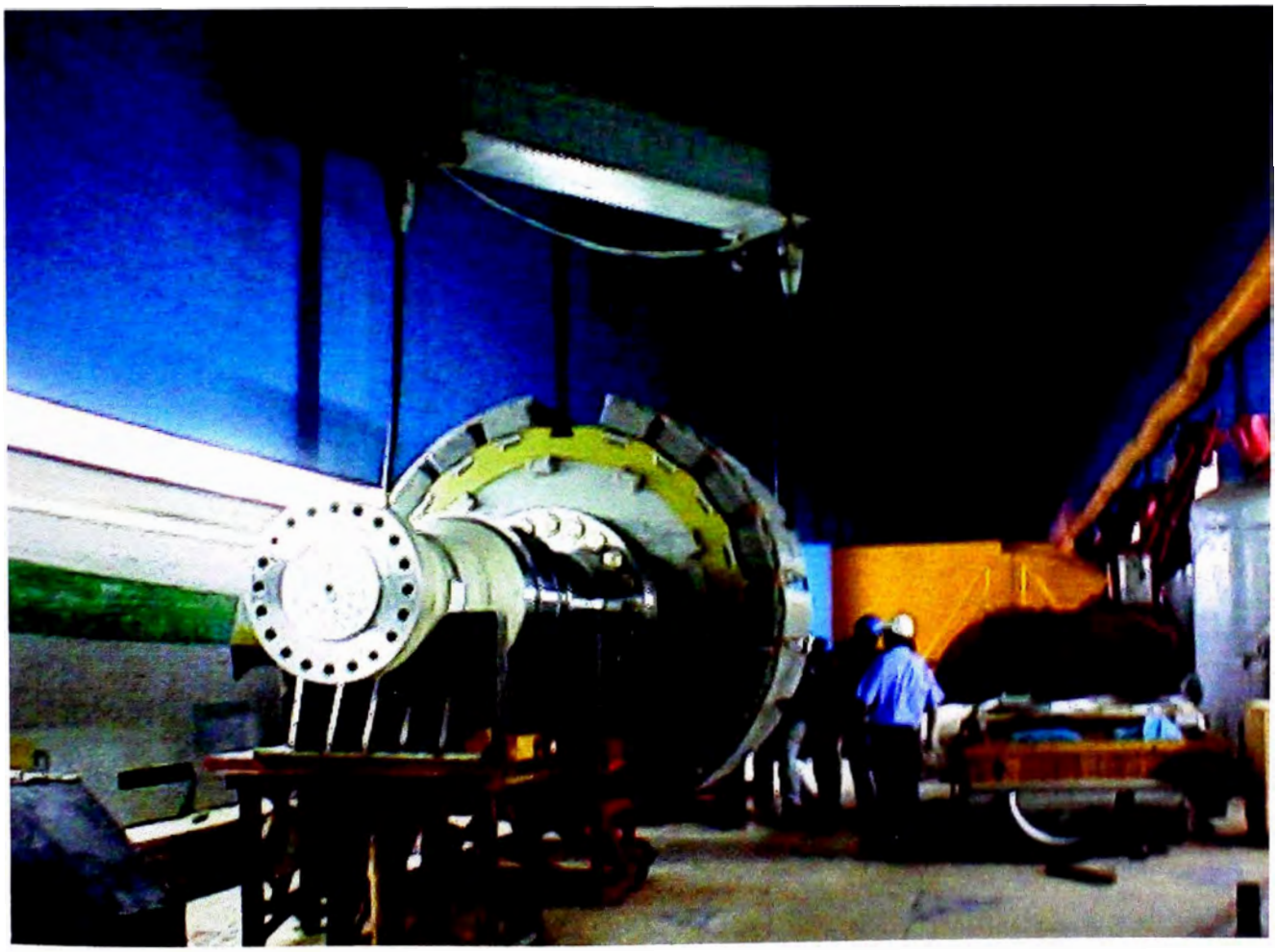
2/2



MONTAJE DEL ROTOR

DEL GENERADOR

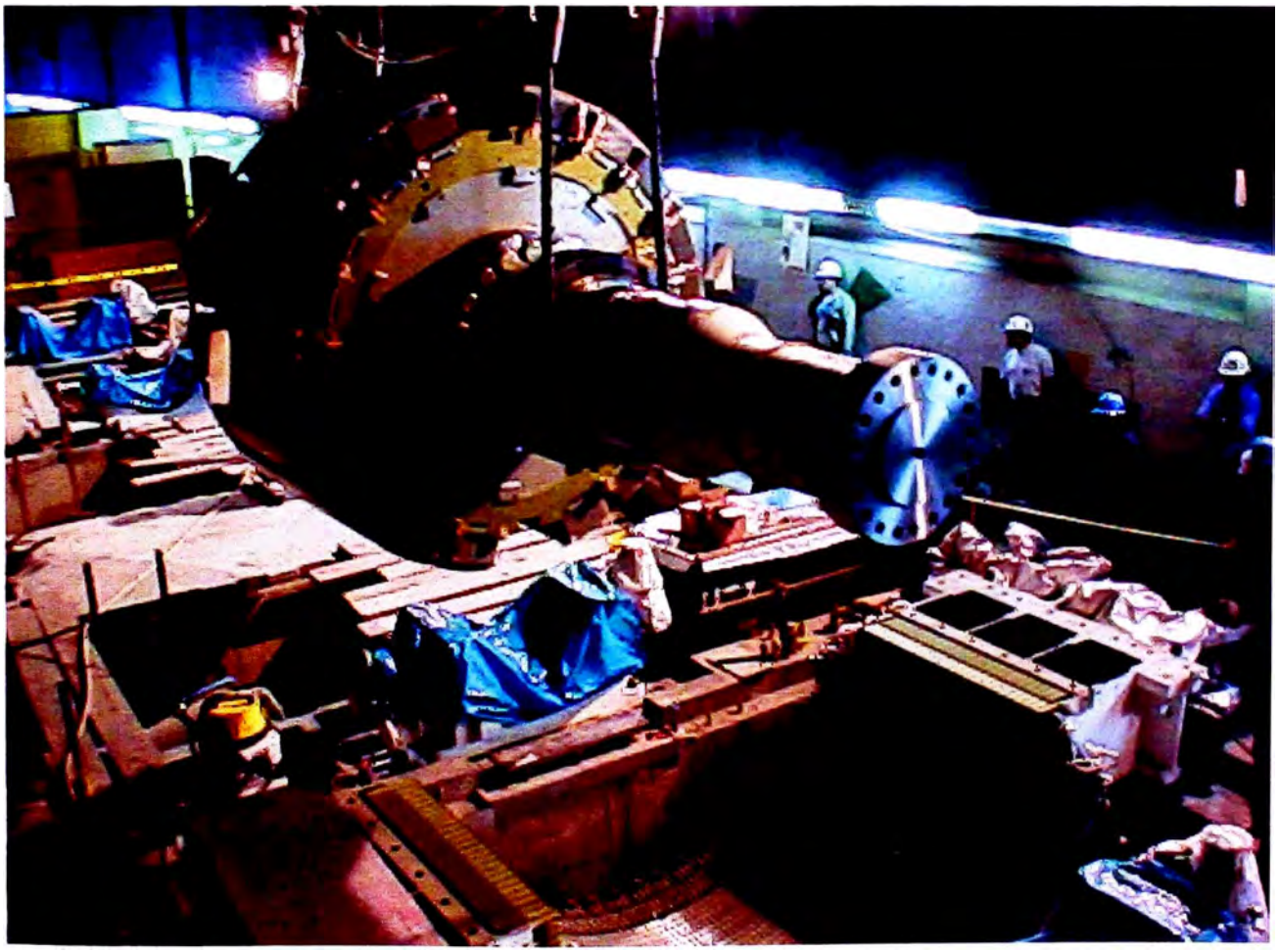
1/2



MONTAJE DEL ROTOR

DEL GENERADOR

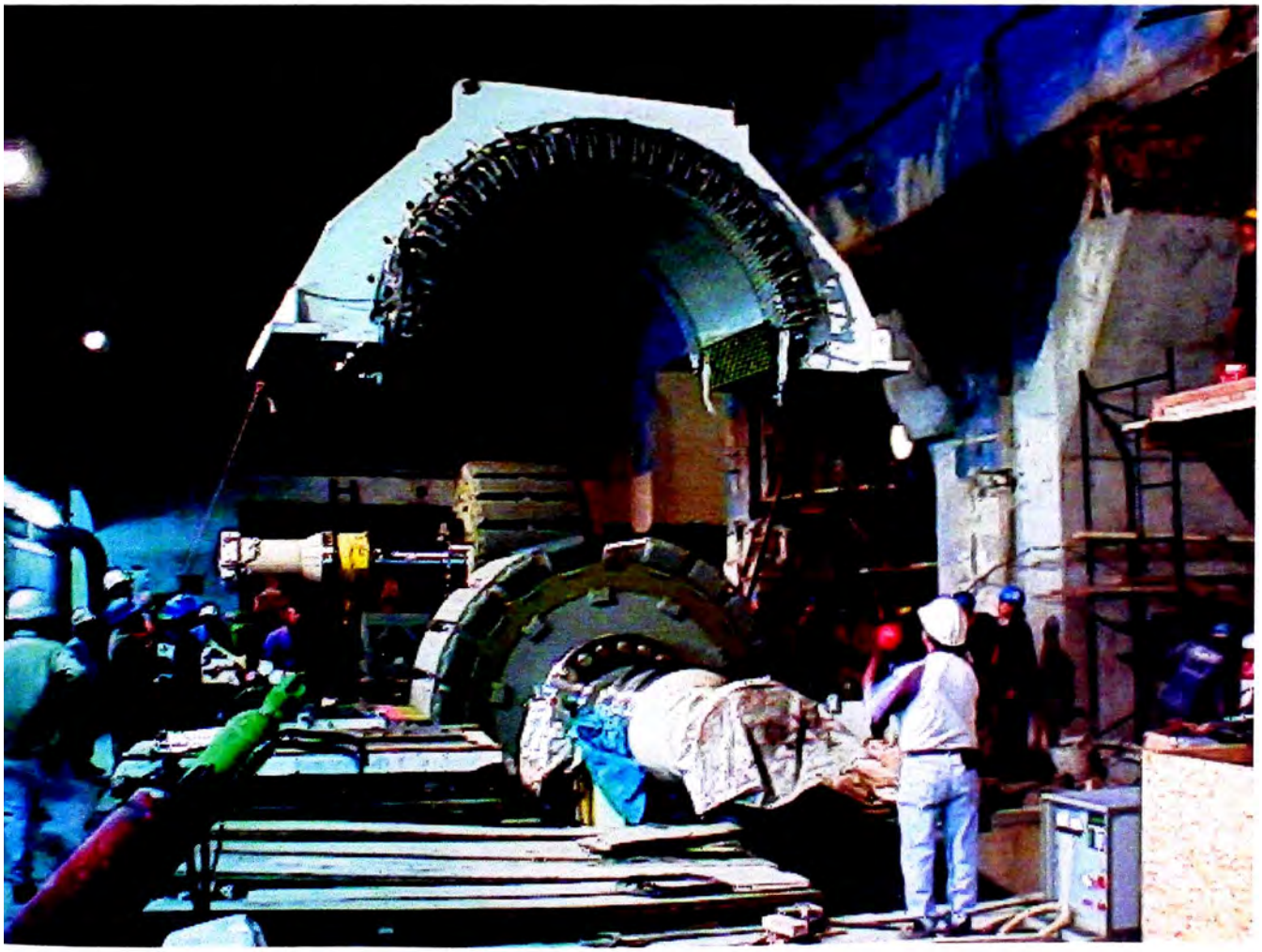
2/2



MONTAJE DE LA PARTE

SUPERIOR DEL ESTATOR

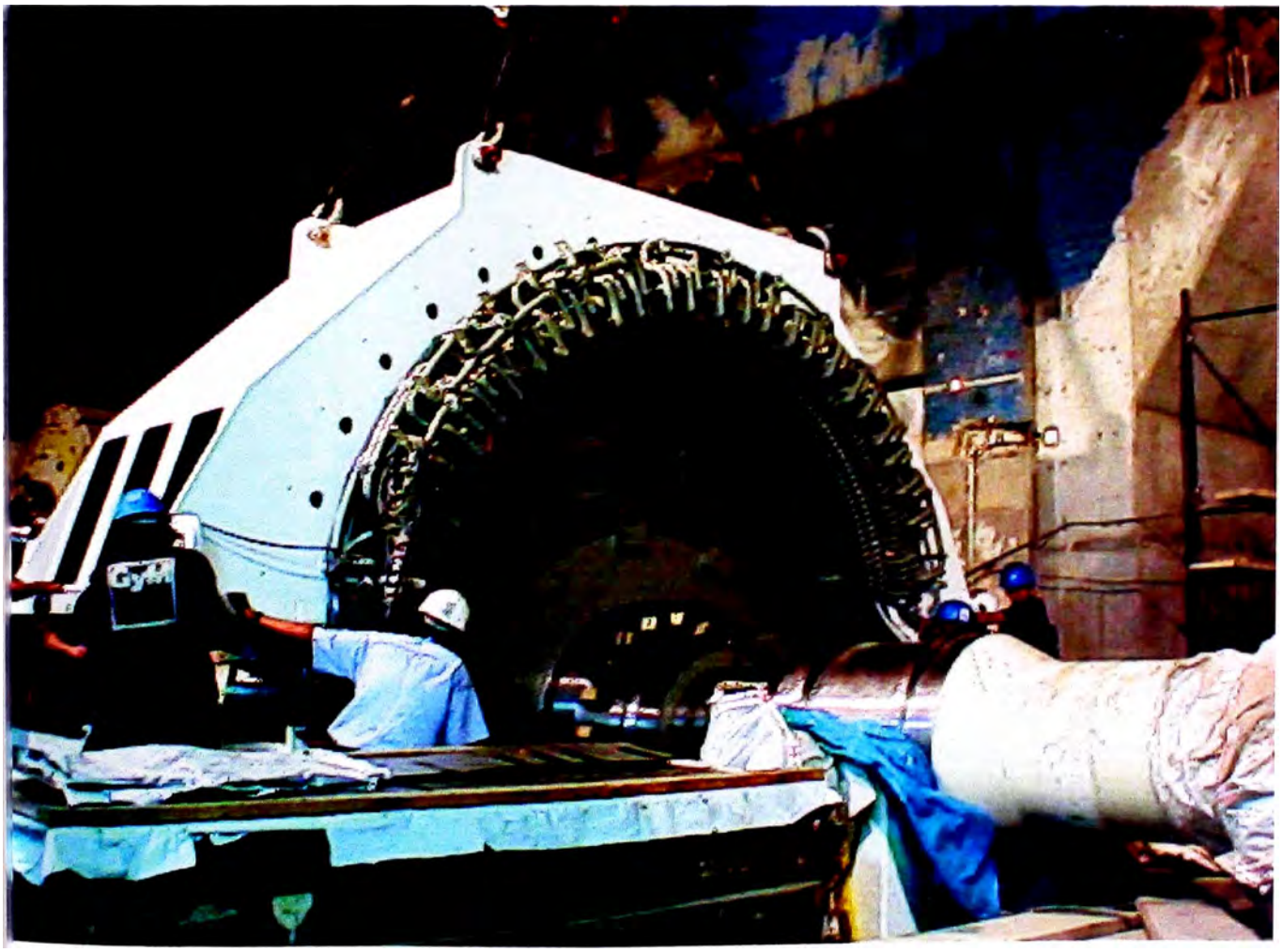
1/2



MONTAJE DE LA PARTE

SUPERIOR DEL ESTATOR

2/2



INGRESO DE LA CARCASA DE LA TURBINA A LA CASA DE MAQUINAS

1/2

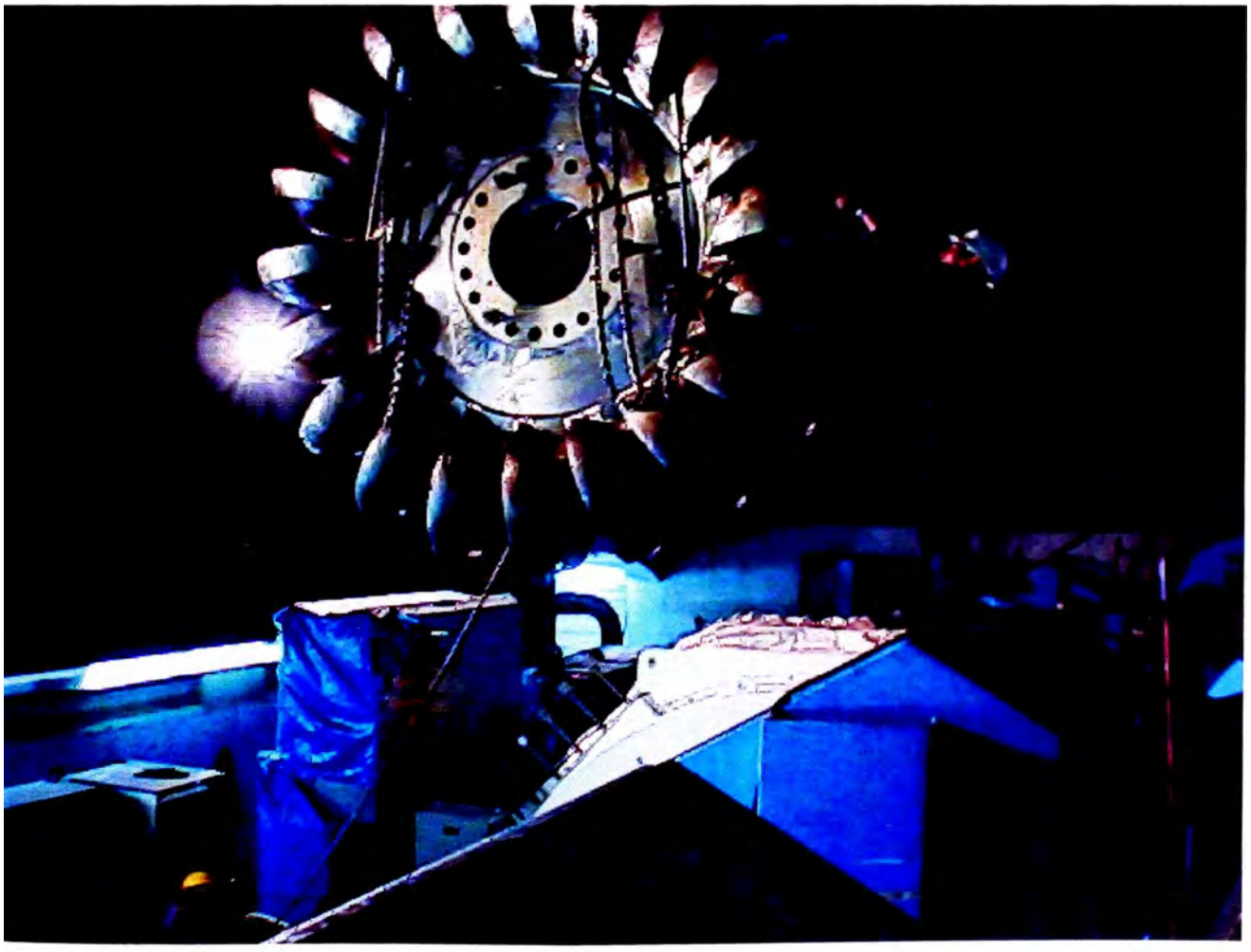
INGRESO DE LA CARCASA DE LA TURBINA A LA CASA DE MAQUINAS

2/2

INSTALACION DE LA

RUEDA PELTON

1/2



INSTALACION DE LA

RUEDA PELTON

2/2

ARREGLO FINAL

DE LA

SALA DE MAQUINAS

ANEXO E

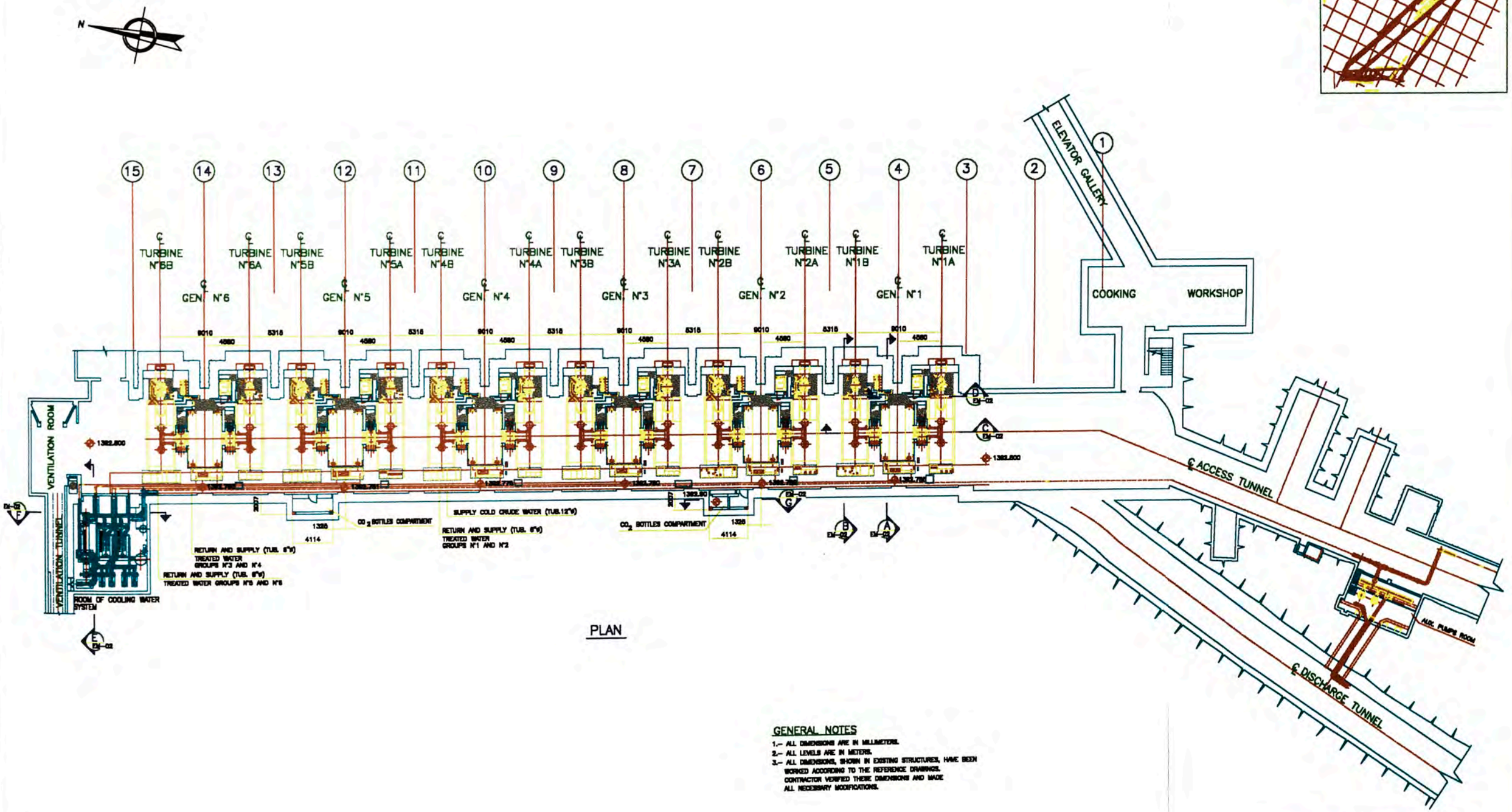
PLANOS AS BUILT MECANICOS

MECHANICAL DRAWING LIST

N°	DESCRIPTION
EM–00	MECHANICAL DRAWING LIST
EM–01	POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – PLAN
EM–02	POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – SECTIONS
EM–03	TURBINES AND GENERATORS – GENERAL ARRANGEMENT GROUP TURBINE – GENERATOR
EM–04 Sh1/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT GROUP TURBINE – GENERATOR – SECTIONS
EM–04 Sh2/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT GROUP TURBINE – GENERATOR – SECTIONS
EM–04 Sh3/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT GROUP TURBINE – GENERATOR – SECTIONS
EM–05 Sh1/2	GENERATOR COOLING WATER SYSTEM – HEAT EXCHANGERS GENERAL ARRANGEMENT – PLAN
EM–05 Sh2/2	GENERATOR COOLING WATER SYSTEM – HEAT EXCHANGERS GENERAL ARRANGEMENT – SECTIONS
EM–09	POWERHOUSE VENTILATION SYSTEM – VENTILATION SYSTEM GENERAL ARRANGEMENT PLAN AND SECTIONS
EM–10 Sh1/2	POWERHOUSE VENTILATION SYSTEM – FAN GENERAL ARRANGEMENT – PLAN AND SECTIONS
EM–10 Sh2/2	POWERHOUSE VENTILATION SYSTEM – FAN GENERAL ARRANGEMENT – PLAN AND SECTIONS
EM–13	TURBINES AND GENERATORS – SCREEN FOR ISOLATION SYSTEM FIREFIGHTING
EM–14 Sh1/2	PENSTOCK RING UNITS 6A, 5A, 5B, 4A, 4B, 3A, 3B, 2A, 2B, 1A & 1B
EM–14 Sh2/2	PENSTOCK RING UNIT 6B
ET–07	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PIPING – PLAN
ET–08	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PIPING – SECTIONS
ET–09 Sh1/3	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PIPING – ISOMETRIC
ET–09 Sh2/3	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PIPING – ISOMETRIC
ET–09 Sh3/3	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PIPING – ISOMETRIC
ET–10	GENERATOR COOLING WATER SYSTEM – P&I DIAGRAM
ET–11	GENERATOR COOLING WATER SYSTEM – GENERAL ARRANGEMENT – PIPING – PLAN
ET–12	GENERATOR COOLING WATER SYSTEM – GENERAL ARRANGEMENT – PIPING – SECTIONS
ET–13	GENERATOR COOLING WATER SYSTEM – HEAT EXCHANGERS – PIPING – PLAN AND SECTIONS
ET–14 Sh1/3	GENERATOR COOLING WATER SYSTEM – HOT AND COLD WATER AT THE CABLE GALLERY – PIPING – PLAN AND SECTIONS
ET–14 Sh2/3	GENERATOR COOLING WATER SYSTEM – HOT AND COLD WATER AT THE CABLE GALLERY – PIPING – PLAN AND SECTIONS
ET–14 Sh3/3	GENERATOR COOLING WATER SYSTEM – HOT AND COLD WATER AT THE CABLE GALLERY – PIPING – PLAN AND SECTIONS
ET–15	GENERATOR COOLING WATER SYSTEM – AIR COOLER AND LUBE OIL BEARING SYSTEM – PIPING – PLAN
ET–16	GENERATOR COOLING WATER SYSTEM – AIR COOLER AND LUBE OIL BEARING SYSTEM – PIPING – SECTIONS
ET–17	GENERATOR COOLING WATER SYSTEM – LUBE OIL BEARING SYSTEM – PIPING – PLAN
ET–18	GENERATOR COOLING WATER SYSTEM – LUBE OIL BEARING SYSTEM – PIPING – SECTIONS
ET–25 Sh1/2	TRANSFORMER COOLING WATER SYSTEM–GENERAL ARRANGEMENT – PIPING – PLAN – TRANSFORMERS BANK 1 AND 2
ET–25 Sh2/2	TRANSFORMER COOLING WATER SYSTEM–GENERAL ARRANGEMENT – PIPING – SECTIONS – TRANSFORMERS BANK 1 AND 2
ET–26	TRANSFORMER COOLING WATER SYSTEM–GENERAL ARRANGEMENT – PIPING – PLAN AND SECTIONS – TRANSFORMER BANK 3
ET–30	LEGEND AND SYMBOLS
ET–31 Sh1/2	STANDARDS OF SUPPORT
ET–31 Sh2/2	STANDARDS OF SUPPORT
ET–32 Sh1/3	POWERHOUSE – GENERATOR N°1 & N°2 – DISTRIBUTION OF SUPPORTS
ET–32 Sh2/3	POWERHOUSE – GENERATOR N°3 & N°4 – DISTRIBUTION OF SUPPORTS
ET–32 Sh3/3	POWERHOUSE – GENERATOR N°5 & N°6 – DISTRIBUTION OF SUPPORTS

AS BUILT DRAWING

PROJECT CODE: 1288	FILE: EM000000	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: E. VEDAS	DRAWING ORG.: E.VEDAS/T.VIERNA		TITLE: MECHANICAL DRAWING LIST
CHECKED: F. CUYA R.			SCL: N/S
APPROVED: A. CLAVIJO P.			DATE: AUG.'98
			CODE: EM–00
			REV. No: 1
			GyM S.A.



PLAN

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.

AS BUILT DRAWING

REFERENCE DRAWING

EC-01 GENERAL ARRANGEMENT – PLAN – LAYOUT
EM-02 POWERHOUSE EQUIPMENT – GENERAL ARRANGEMENT – SECTIONS

PROJECT CODE: 1288	FILE: EM000001
DESIGNED: F. CUYA R.	DRAWING CHK.: M.MUNOZ/T.VERA
CHECKED: J. FERNANDEZ	
APPROVED: A. CLAVIJO P.	

ABB POWER GENERATION INC.

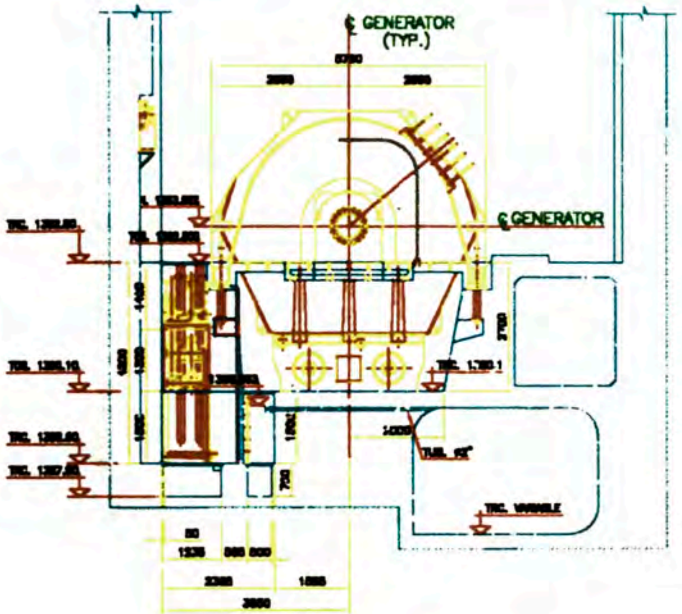
GEC S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

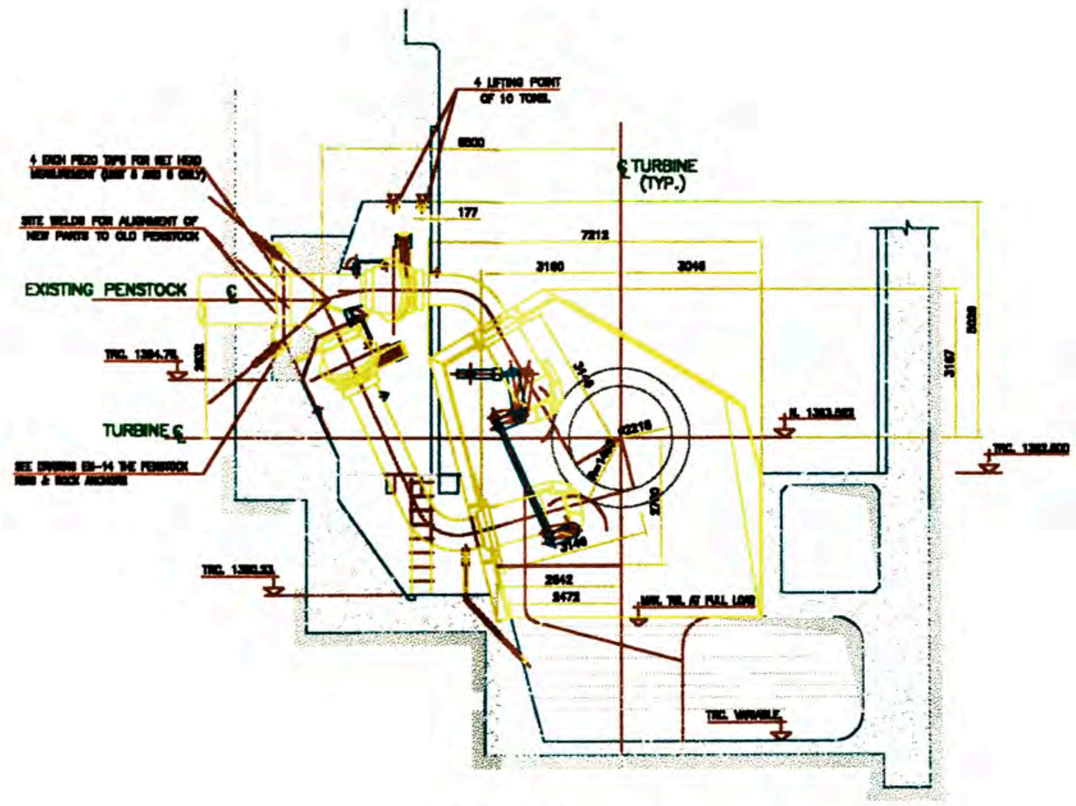
TITLE: POWERHOUSE EQUIPMENT GENERAL ARRANGEMENT PLAN

SCALE: 1/200	CODE: EM–01	REV. No: 1
DATE: AUG.'99		

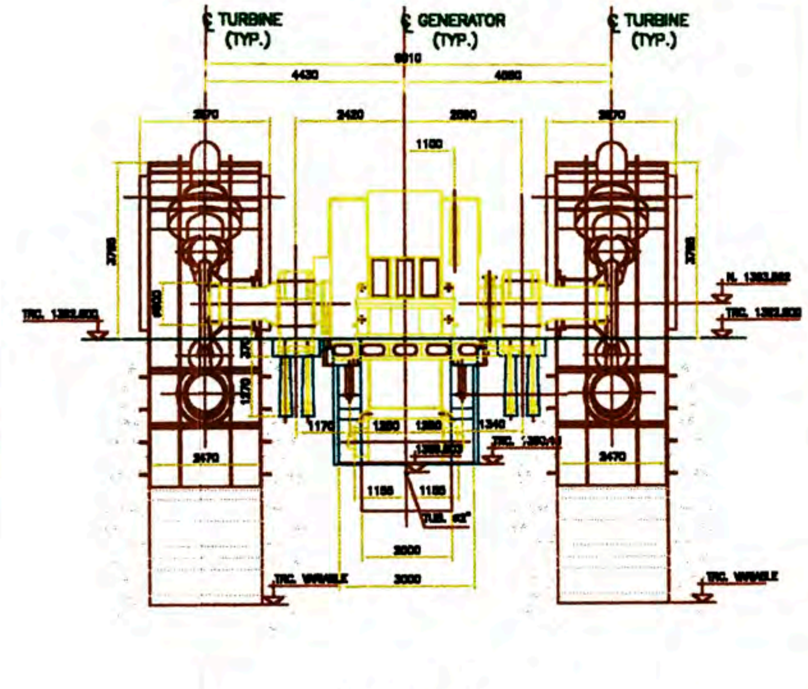
GyM S.A.



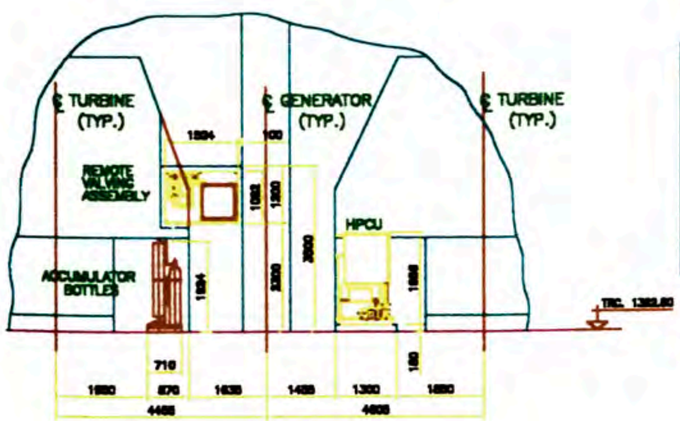
SECTION A
SC. 1/75
EM-01



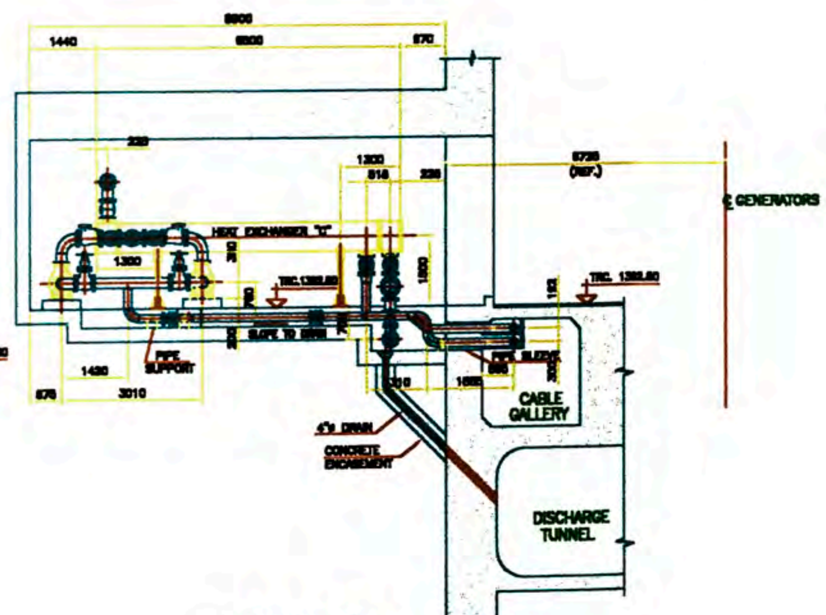
SECTION B
SC. 1/75
EM-01



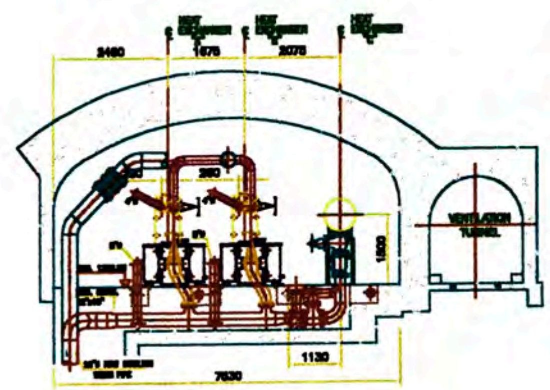
SECTION C
SC. 1/75
EM-01



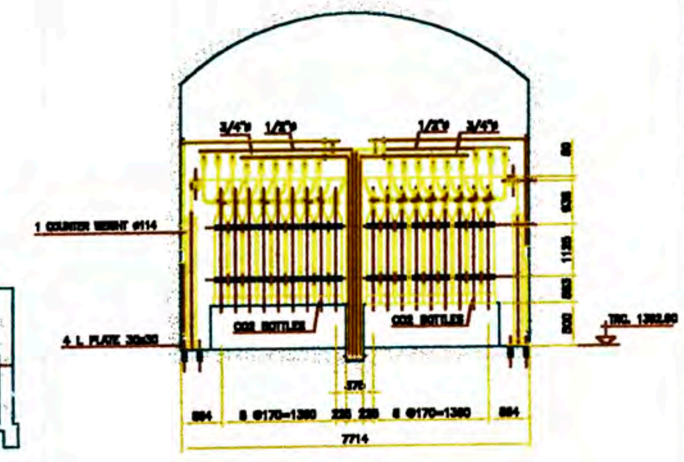
SECTION D
SC. 1/75
EM-01



SECTION E
SC. 1/75
EM-01



SECTION F
SC. 1/75
EM-01



SECTION G
SC. 1/40
EM-01

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.

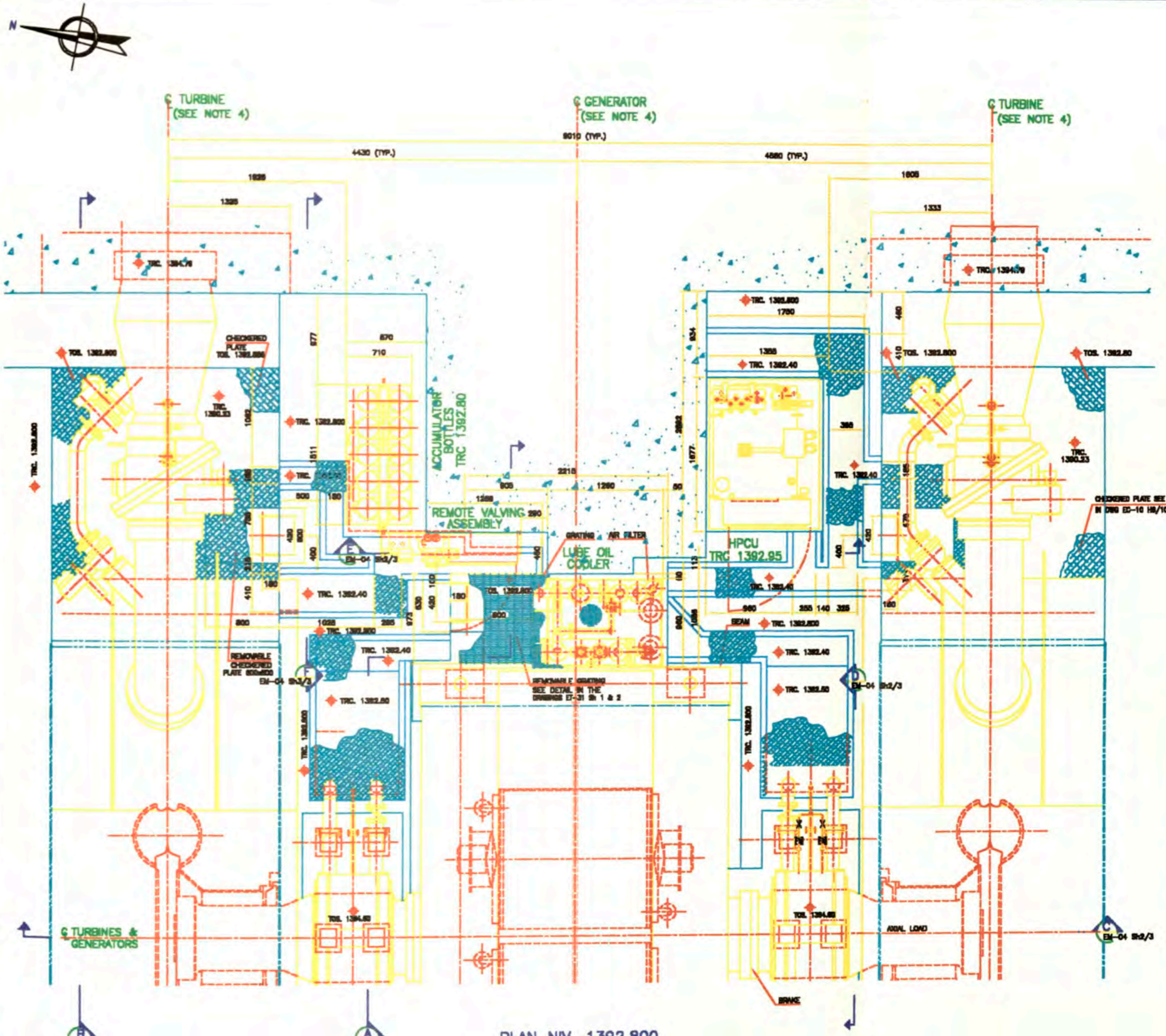
AS BUILT DRAWING

REFERENCE DRAWING

EM-01 POWERHOUSE - EQUIPMENT - GENERAL ARRANGEMENT - PLAN
E7-13 GENERATOR COOLING WATER SYSTEM - GENERAL ARRANGEMENT - PIPING - PLAN
EM-14 PENSTOCK RING (Sh1 & 2)

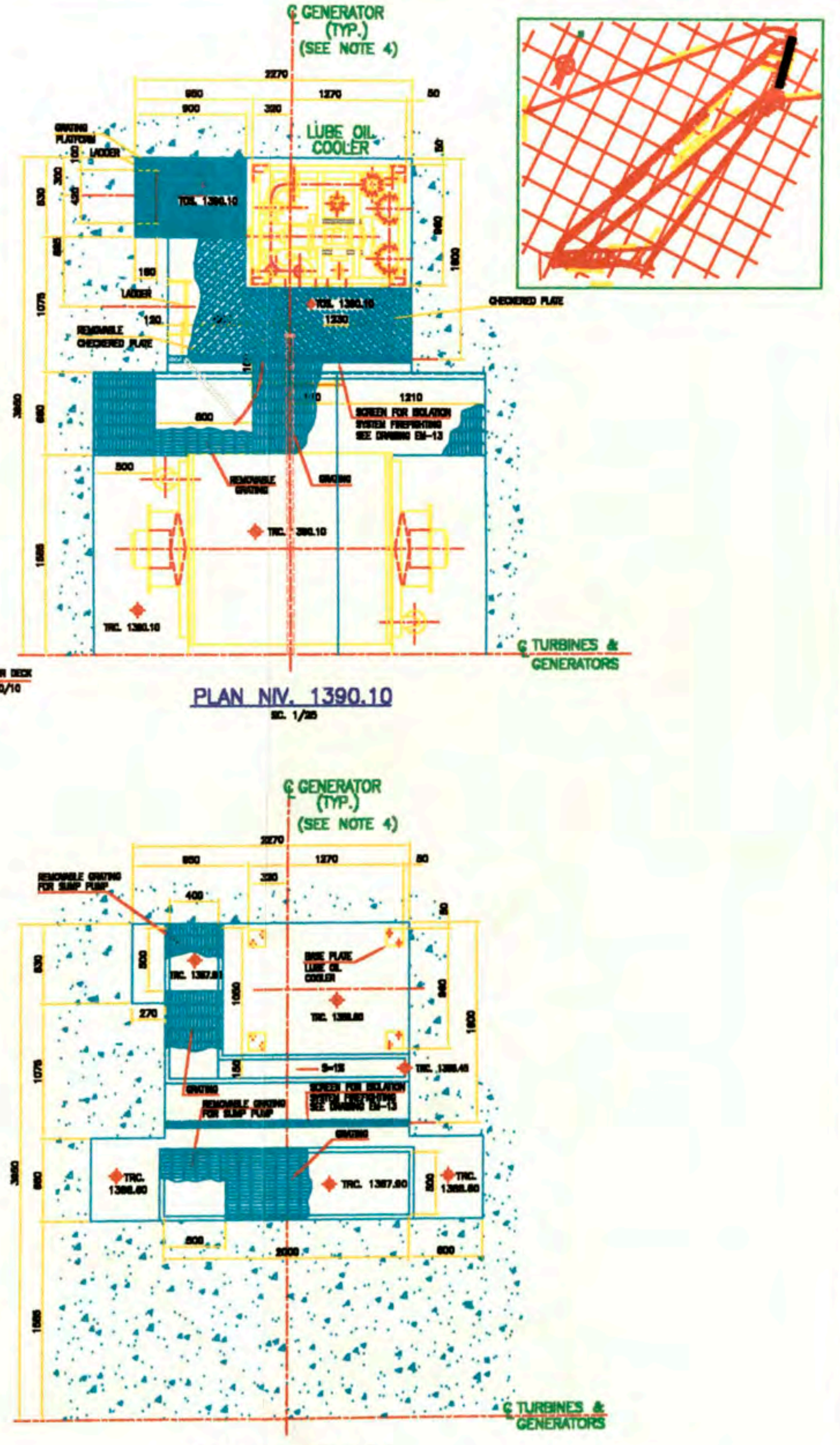
PROJECT CODE: 1280	FILE: EM000002	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW
DESIGNED: F. CUYA R.			TITLE: POWERHOUSE EQUIPMENT GENERAL ARRANGEMENT SECTIONS
CHECKED: J. FERNANDEZ			SCALE: IND.
APPROVED: A. OLAVIDE F.			DATE: AUG.'98
			CODE: EM-02
			REV. No: 1

GyM S.A.



PLAN NIV. 1392.800

SC. 1/25



PLAN NIV. 1390.10

SC. 1/25

PLAN NIV. 1388.60

SC. 1/25

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- THIS ARRANGEMENT IS VALID FOR ALL GROUPS TURBINE-GENERATOR.

REFERENCE DRAWING

EM-01	POWERHOUSE EQUIPMENT – GENERAL ARRANGEMENT – PLAN
EM-04 Sh1/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR – SECTIONS
EM-04 Sh2/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR – SECTIONS
EM-04 Sh3/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR – SECTIONS

AS BUILT DRAWING

PROJECT CODE: 1286	FILE: EM000003
DESIGNED: J. FERNANDEZ	DRAWING CAD.:
CHECKED: F. CUYA R.	
APPROVED: A. OLAVIDE P.	

ABB

POWER GENERATION INC.

PROJECT: EGENOR S.A.

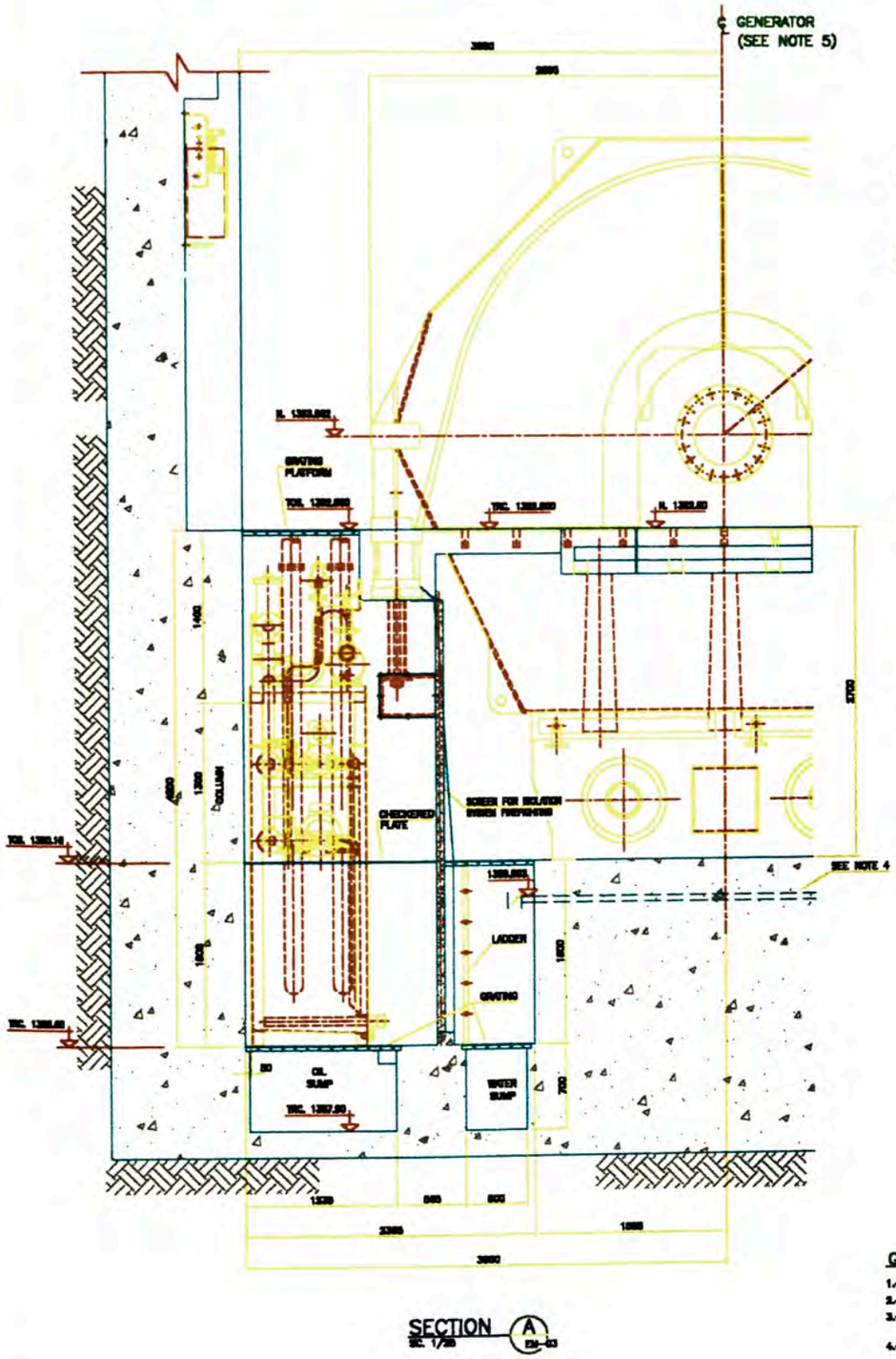
Empresa de Generación Eléctrica Nor Perú S.A.

CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

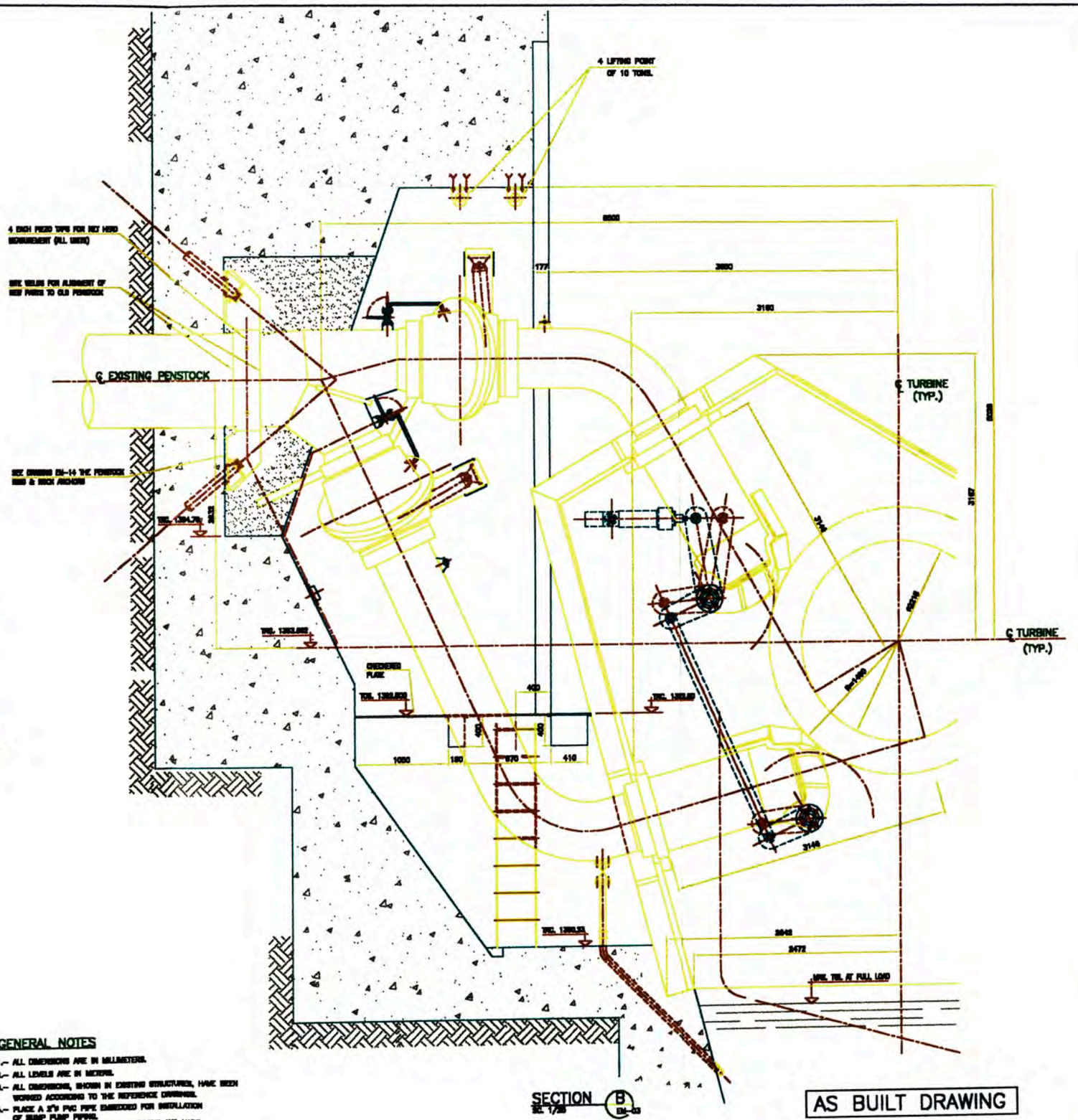
TITLE: TURBINES AND GENERATORS GENERAL ARRANGEMENT GROUP TURBINE – GENERATOR

SC.: 1/25	CODE: EM-03	REV. No 1
DATE: AUG.'99		

GyM S.A.



SECTION A
SC. 1/25 EM-03



SECTION B
SC. 1/25 EM-03

AS BUILT DRAWING

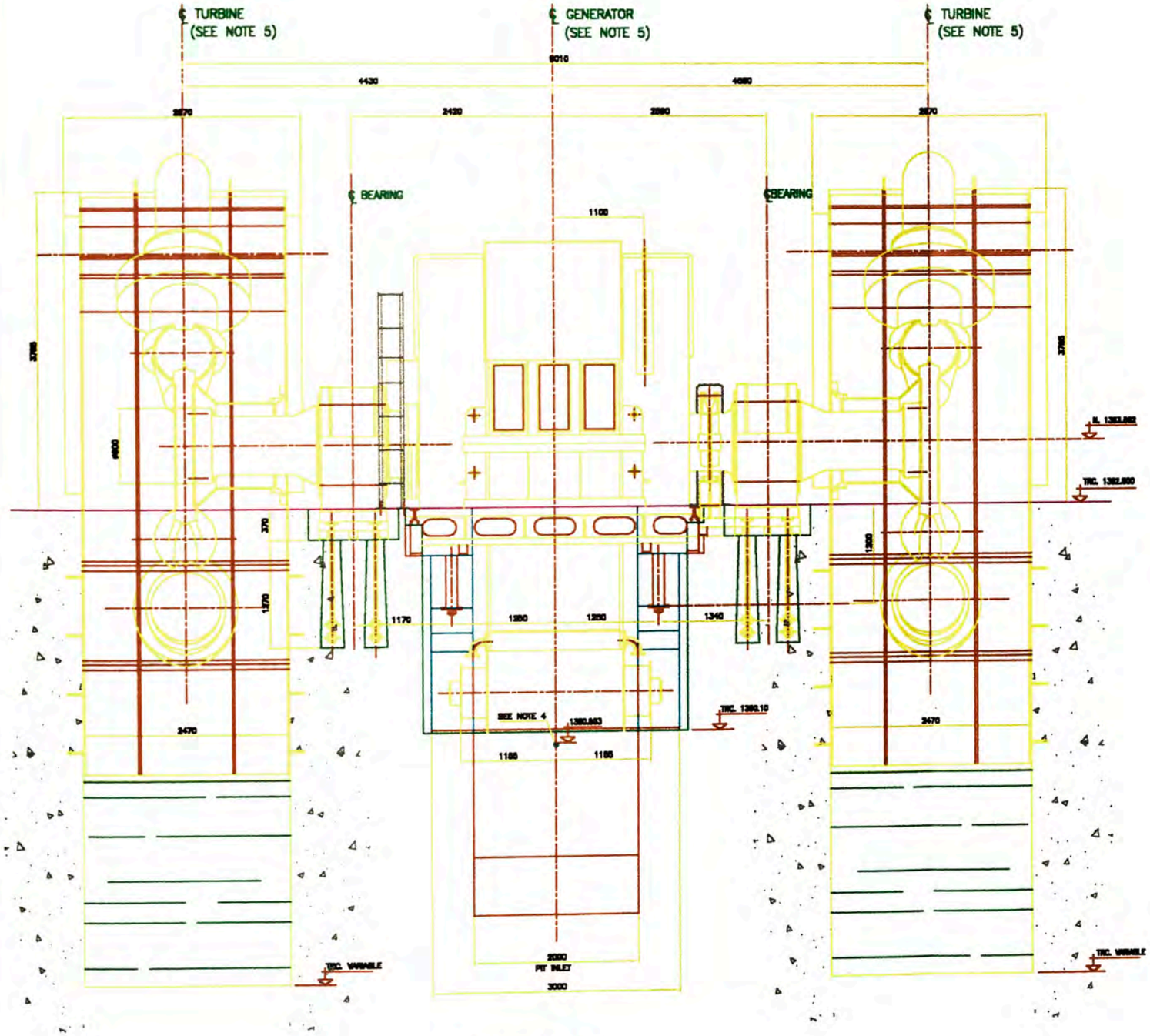
GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS.
4.- PLACE A 3"ø PVC PIPE EMBEDDED FOR INSTALLATION OF SUMP PUMP PIPING. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
5.- THIS ARRANGEMENT IS VALID FOR ALL GROUPS TURBINE-GENERATOR.

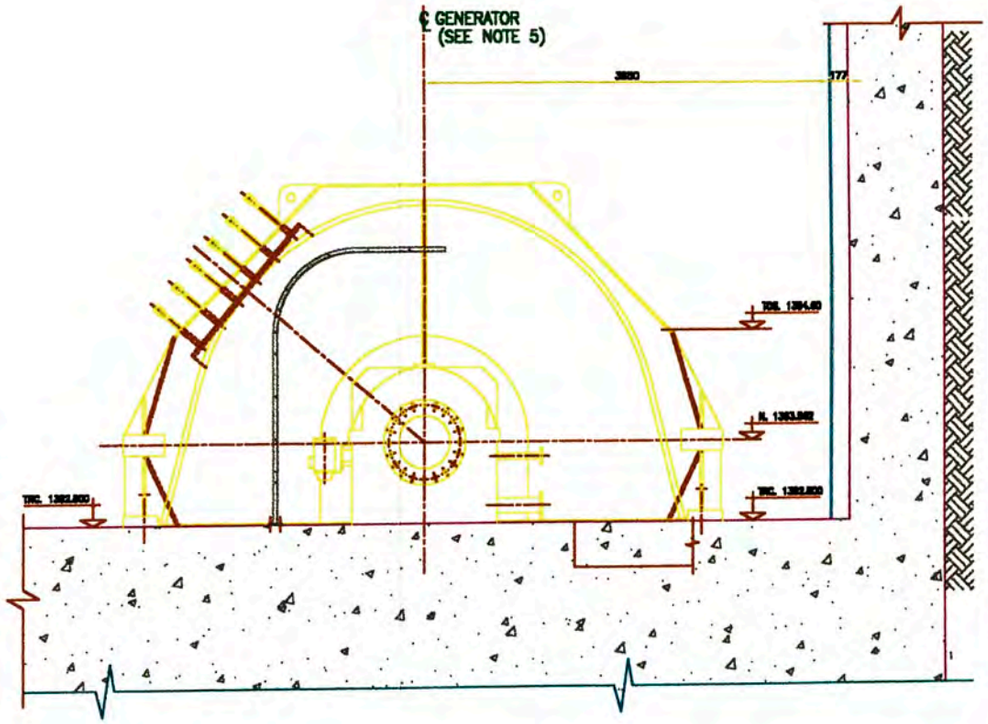
REFERENCE DRAWING

EM-01	POWERHOUSE EQUIPMENT – GENERAL ARRANGEMENT – PLAN
EM-03	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR
EM-04 Sh2/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR – SECTIONS
EM-04 Sh3/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR – SECTIONS

PROJECT CODE: 1288	FILE: EM000004	ABB POWER GENERATION INC.	EGENOR S.A. Empresa de Generación Eléctrica Ner Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 340 MW
DRAWN: J. FERNANDEZ	DRAWING SHEET:		TITLE: TURBINES & GENERATORS GENERAL ARRANGEMENT GROUP TURBINE – GENERATOR – SECTIONS
CHECKED: F. CUYA R.			SCALE: 1/25
APPROVED: A. CLAVEZ P.			DATE: AUG.'99
			CODE: EM–04 Sh1/3
			REV. No: 1
			GyM S.A.



SECTION C
SC. 1/50 EM-03



SECTION D
SC. 1/50 EM-03

GENERAL NOTES

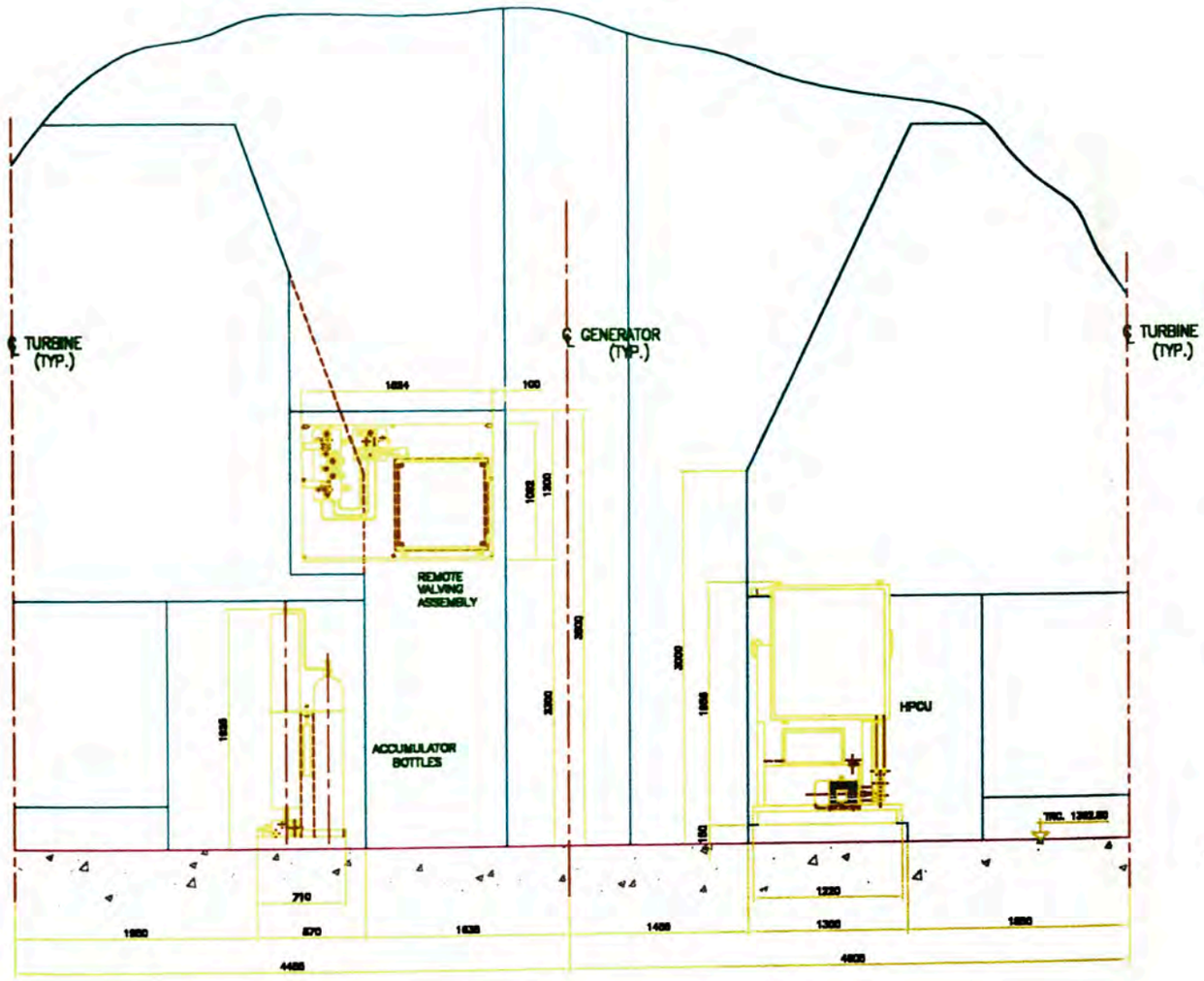
1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS.
4.- A 2"ø PVC PIPE EMBEDDED WAS PLACED FOR INSTALLATION OF SUMP PUMP PIPING.
CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
5.- THIS ARRANGEMENT IS VALID FOR ALL GROUPS TURBINE-GENERATOR.

AS BUILT DRAWING

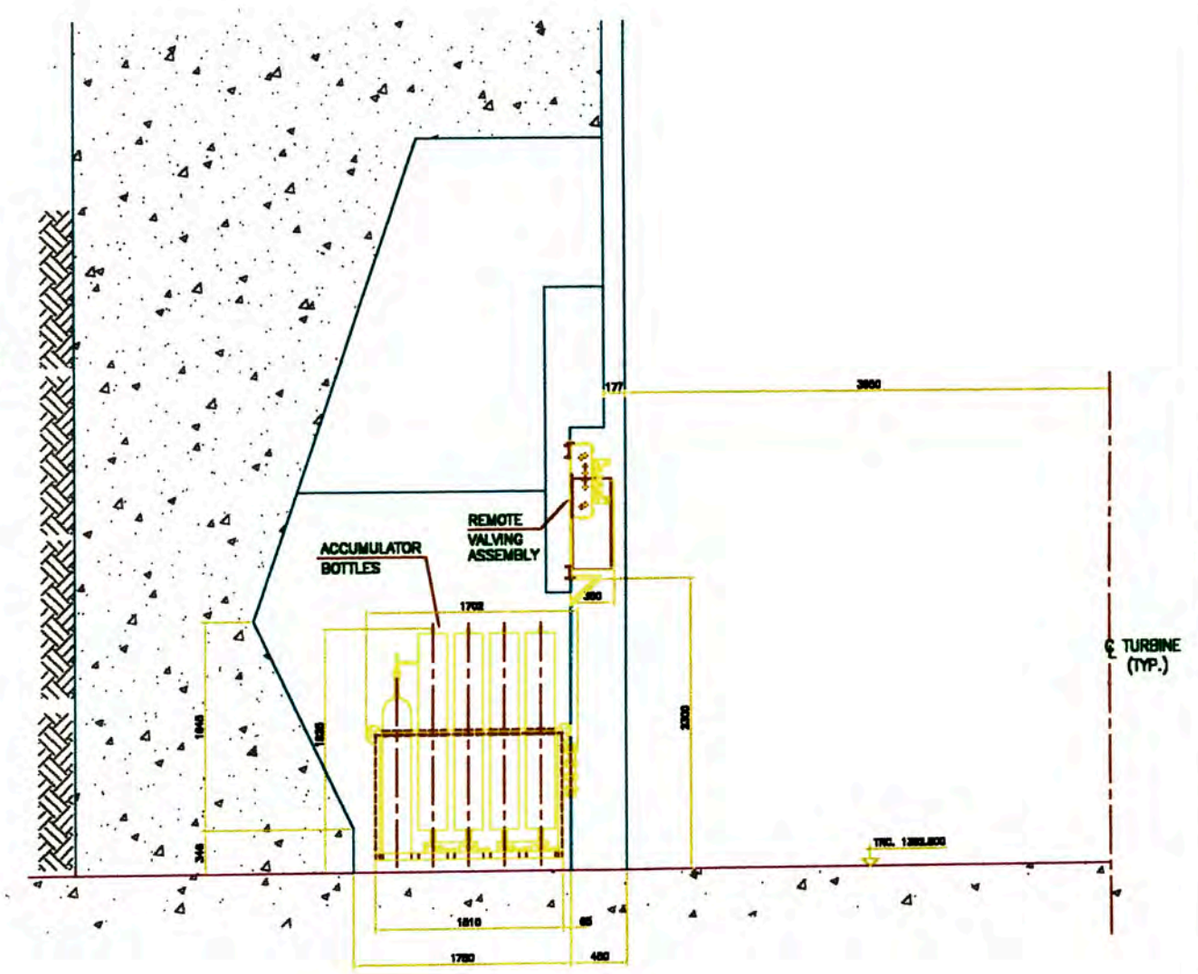
REFERENCE DRAWING

EM-01	POWERHOUSE EQUIPMENT - GENERAL ARRANGEMENT - PLAN
EM-03	TURBINES AND GENERATORS - GENERAL ARRANGEMENT - GROUP TURBINE-GENERATOR
EM-04 Sh1/3	TURBINES AND GENERATORS - GENERAL ARRANGEMENT - GROUP TURBINE-GENERATOR - SECTIONS
EM-04 Sh2/3	TURBINES AND GENERATORS - GENERAL ARRANGEMENT - GROUP TURBINE-GENERATOR - SECTIONS

PROJECT CODE: 1389	FILE: EM00004A	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CARÓN DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW
DESIGNED: J. FERNANDEZ	DRAWN: GIELI		TITLE: TURBINE AND GENERATORS GENERAL ARRANGEMENT GROUP TURBINE - GENERATOR - SECTIONS
CHECKED: F. CUYA R.			GyM S.A.
APPROVED: A. OLAVIDE P.			SCA.: 1/20 CODE: EM-04 Sh2/3 REV. No: 1 DATE: AUG.'98



SECTION E
SCL 1/25 EM-03



SECTION F
SCL 1/25 EM-03

GENERAL NOTES

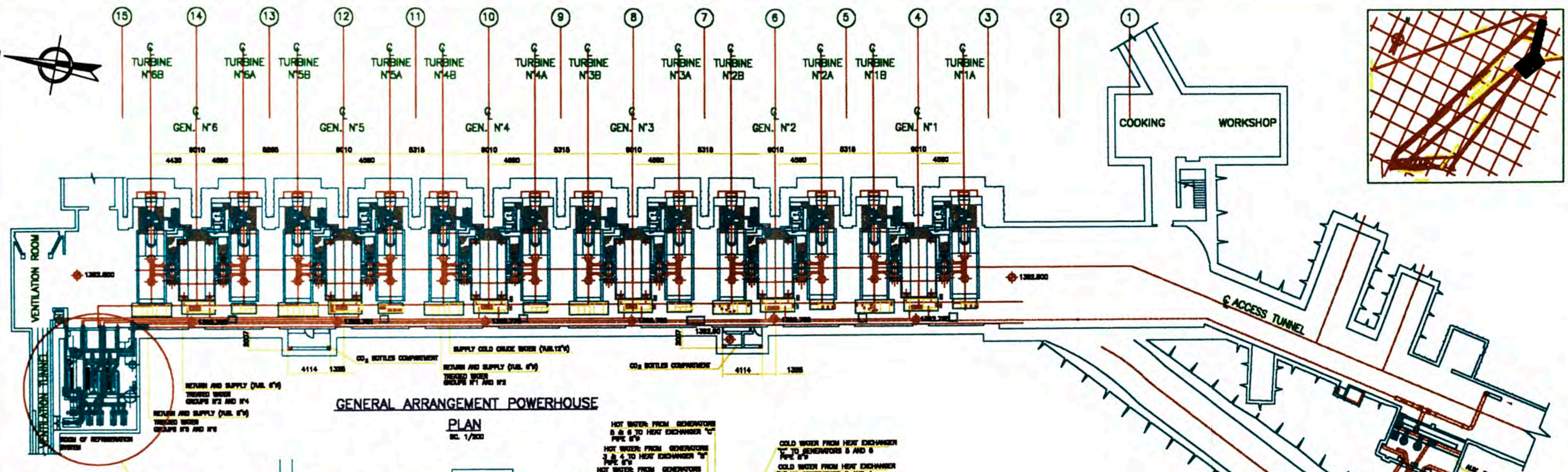
1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- THIS ARRANGEMENT IS VALID FOR ALL GROUPS TURBINE-GENERATOR.

AS BUILT DRAWING

REFERENCE DRAWING

EM-01	POWERHOUSE EQUIPMENT – GENERAL ARRANGEMENT – PLAN
EM-03	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR
EM-04 Sh1/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR – SECTIONS
EM-04 Sh2/3	TURBINES AND GENERATORS – GENERAL ARRANGEMENT – GROUP TURBINE-GENERATOR – SECTIONS

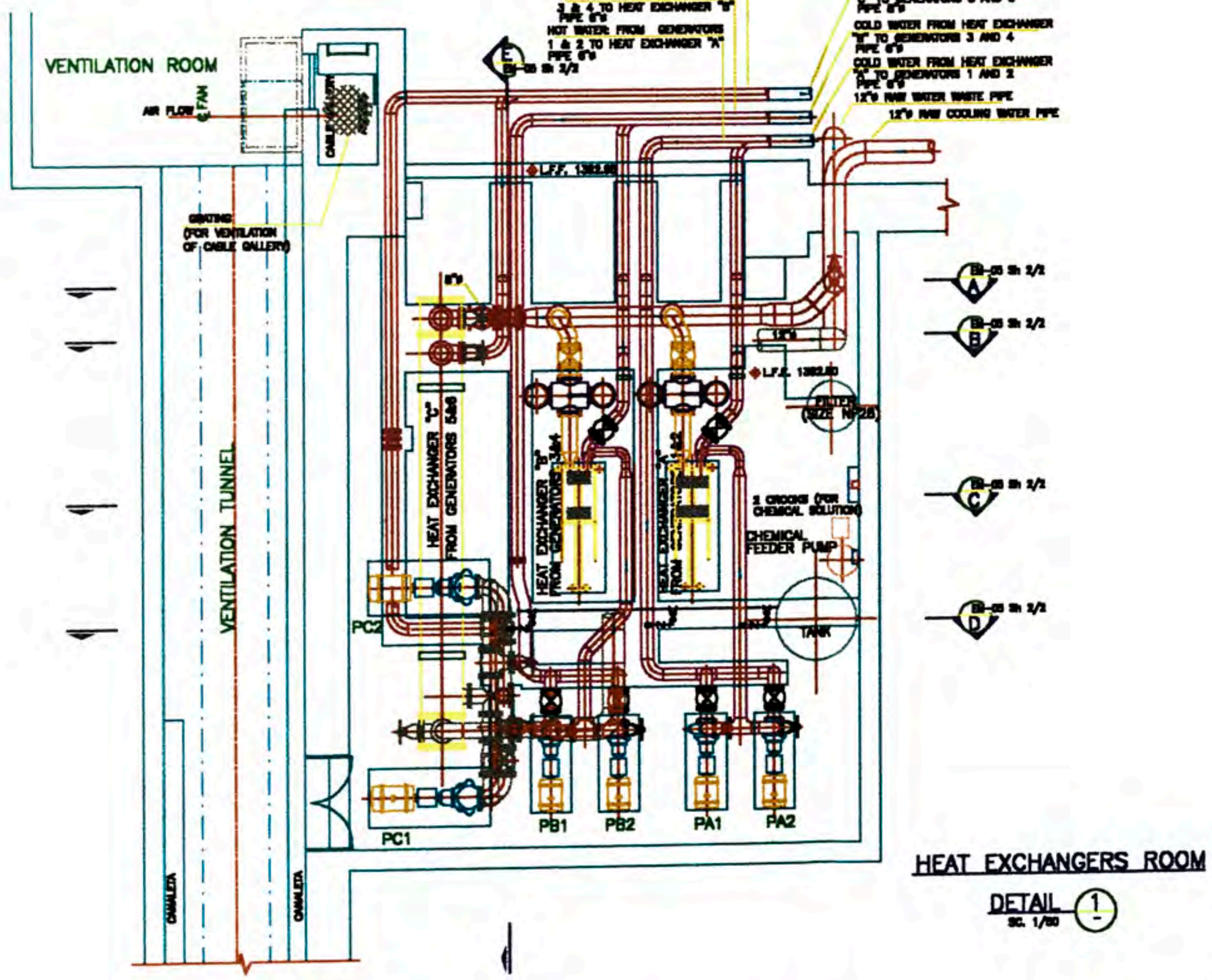
PROJECT CODE: 1288	FILE: EM000048	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: F. CUYA R.	DESIGN CHK.: GUILLERMO/CHRIS		TITLE: TURBINES AND GENERATORS GENERAL ARRANGEMENT GROUP TURBINE – GENERATOR – SECTIONS
CHECKED: F. CUYA R.			GyM S.A.
APPROVED: A. CLARKE F.			SCL: 1/25 DATE: AUG.'98 CODE: EM-04 Sh3/3 REV. No: 1



GENERAL ARRANGEMENT POWERHOUSE

PLAN

SC. 1/300



HEAT EXCHANGERS ROOM

DETAIL 1

SC. 1/50

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- HEAT EXCHANGER "C" WAS REUSED. THE TYPE OF HEAT EXCHANGERS "A" AND "B" WERE NEW.

AS BUILT DRAWING

REFERENCE DRAWING

EM-01	POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – PLAN
EM-05 Sh2/2	GENERATOR COOLING WATER SYSTEM – HEAT EXCHANGERS – GENERAL ARRANGEMENT – SECTIONS
ET-13	GENERATOR COOLING WATER SYSTEM – HEAT EXCHANGERS – PIPING – PLAN AND SECTIONS

PROJECT CODE: 1288	FILE: EM000005
DESIGNED: F. CUYA R.	DRAWING CAD.: [illegible]
CHECKED: J. FERNANDEZ	
APPROVED: A. OLANDE P.	

ABB POWER GENERATION INC.

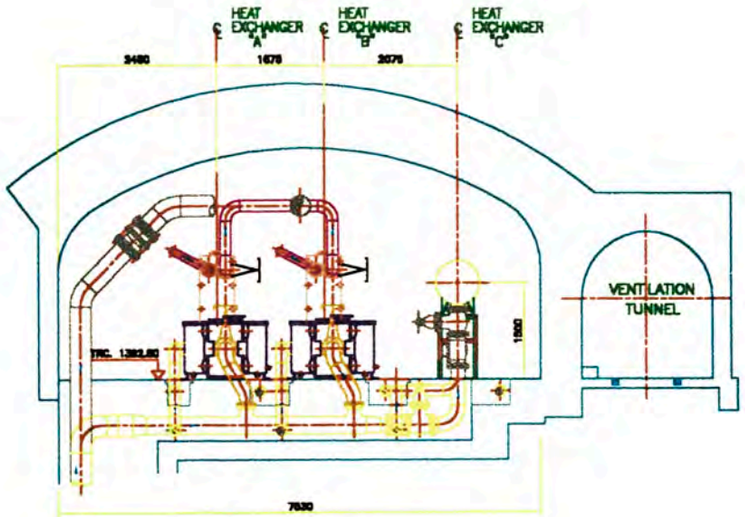
GyM S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

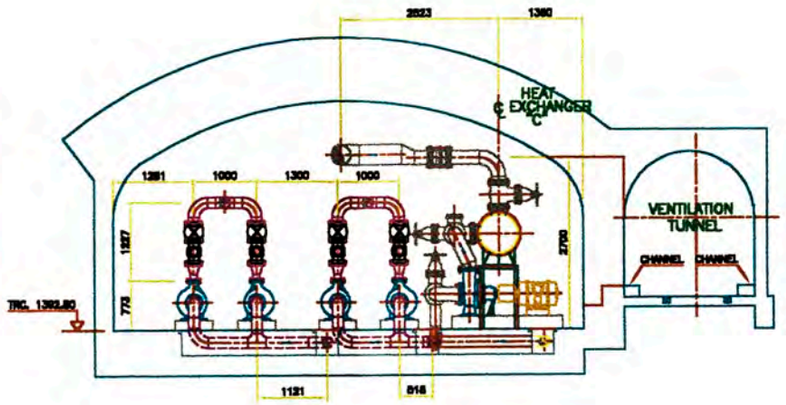
TITLE: GENERATOR COOLING WATER SYSTEM
HEAT EXCHANGERS GENERAL ARRANGEMENT
PLAN

SC.: IND.	CODE: EM-05 Sh1/2	REV. N°: 1
DATE: AUG.'99		

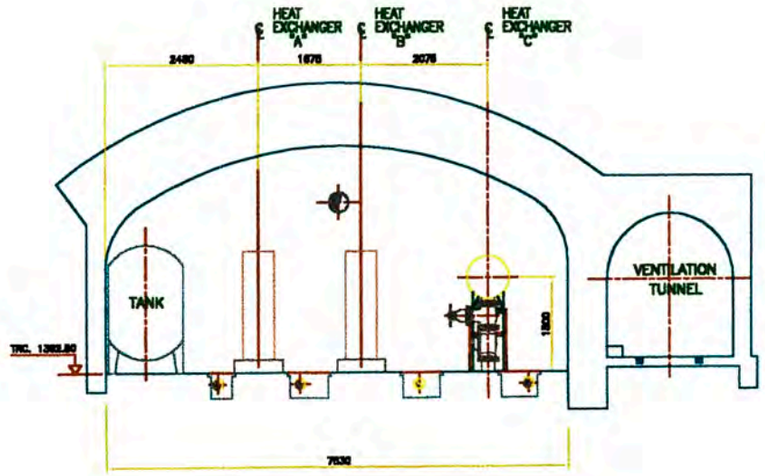
GyM



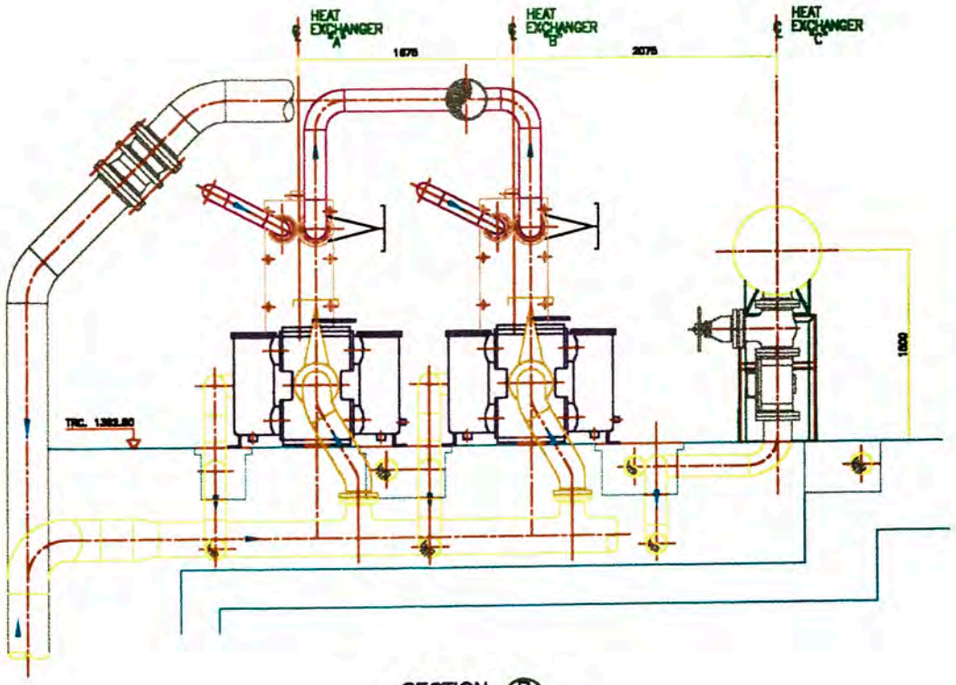
SECTION A
ESC.1/50 EM-05 Sh1/2



SECTION D
ESC.1/50 EM-05 Sh1/2



SECTION C
ESC.1/50 EM-05 Sh1/2



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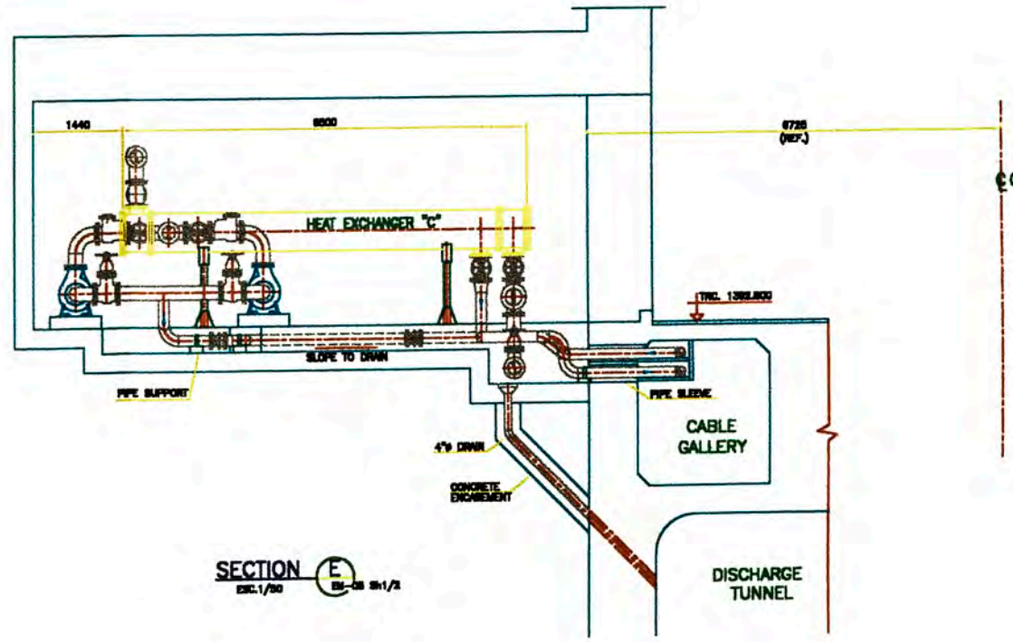
ESC.1/25 EM-05 Sh1/2



SECTION E
ESC.1/50 EM-05 Sh1/2

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN TAKEN ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECCESSARY MODIFICATIONS.
4.- HEAT EXCHANGER "C" WAS REUSED. THE TYPE OF HEAT EXCHANGERS "A" AND "B" WERE NEW.

REFERENCE DRAWING

EM-01 POWER HOUSE - EQUIPMENT GENERAL ARRANGEMENT - PLAN
ET-13 GENERATOR COOLING WATER SYSTEM - HEAT EXCHANGERS - PIPING - PLAN AND SECTIONS

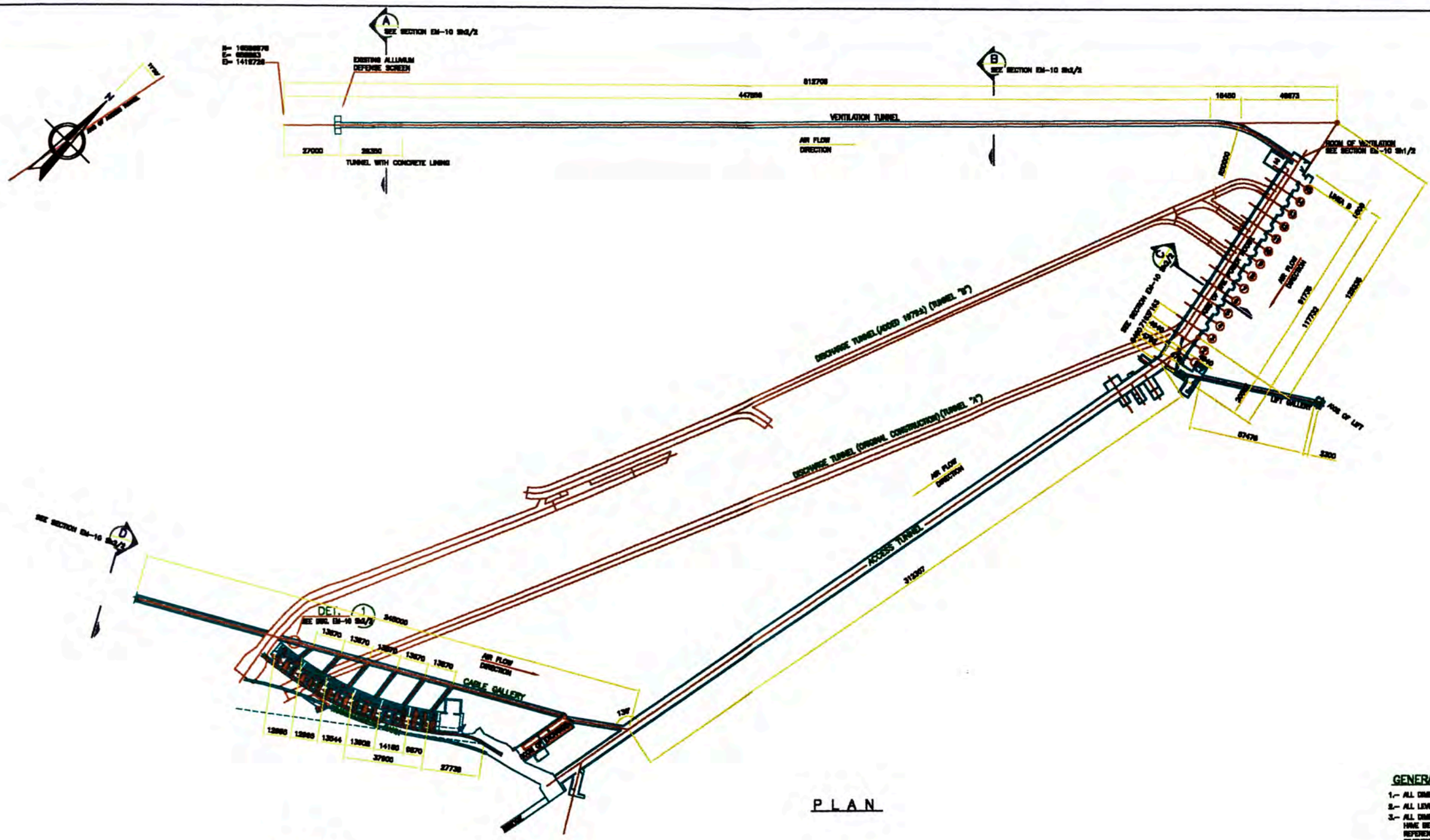
PROJECT CODE: 1269	FILE: EM0005A
DESIGNED: F. CUYA R.	DRAWING CKD.: KUBAILAN/CHERA
CHECKED: J. FERNANDEZ	
APPROVED: A. CLAUDE P.	

ABB POWER GENERATION INC.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW
TITLE: GENERATOR COOLING WATER SYSTEM
HEAT EXCHANGERS GENERAL ARRANGEMENT
SECTIONS

SCL: 1/50	CODE: EM-05 Sh2/2	REV. No: 1
DATE: AUG.'98		

GyM S.A.



PLAN

LONGITUDINAL PROFILE
VENTILATION TUNNEL

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECCESSARY MODIFICATIONS.

AS BUILT DRAWING

REFERENCE DRAWING

EM-01 POWERHOUSE - EQUIPMENT GENERAL ARRANGEMENT - PLAN
EM-10 Sh1/2 POWERHOUSE - VENTILATION SYSTEM - FAN - GENERAL ARRANGEMENT - PLAN AND SECTIONS
EM-10 Sh2/2 POWERHOUSE - VENTILATION SYSTEM - FAN - GENERAL ARRANGEMENT - PLAN AND SECTIONS

PROJECT CODE: 1999	FILE: EM0000S
DESIGNED: F. CUYA R.	DRAWING CHECKED: M.MAJON/T.VERA
CHECKED: F. CUYA R.	
APPROVED: A. CLAVIJO P.	

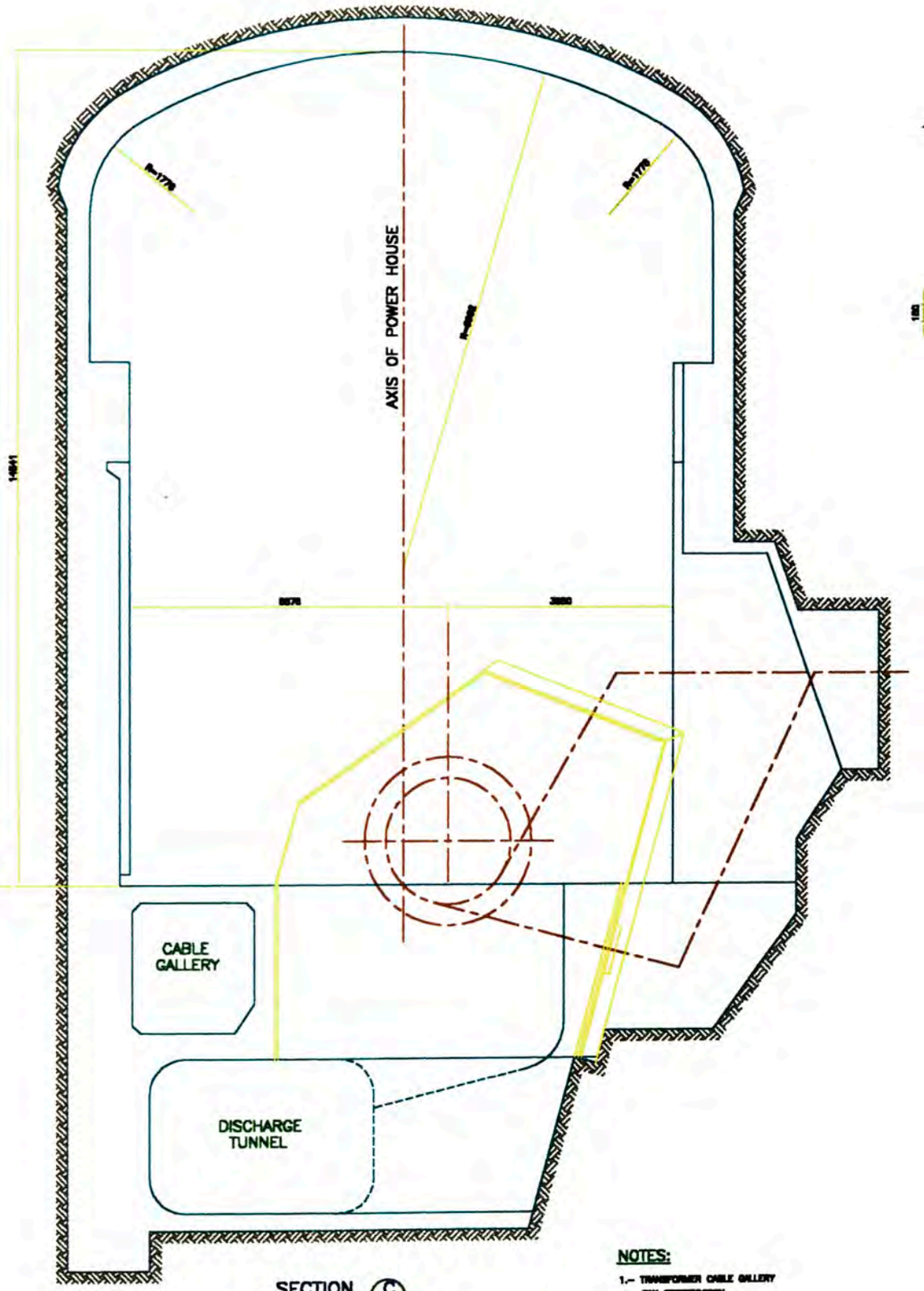
ABB POWER GENERATION INC.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW

TITLE: POWER HOUSE VENTILATION SYSTEM
VENT. SYSTEM GENERAL ARRANGEMENT
PLAN AND SECTIONS

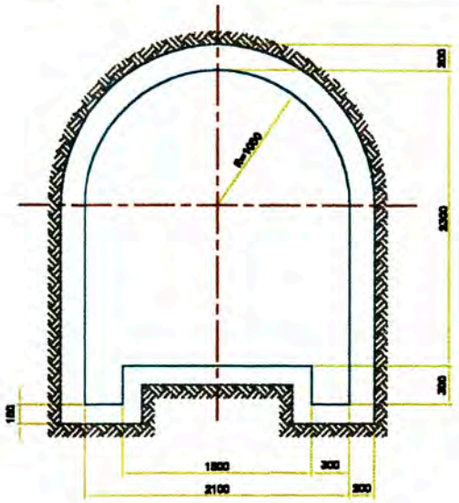
SCALE: 1/1000	CODE: EM-09	REV. No: 1
DATE: AUG.'99		

GyM S.A.

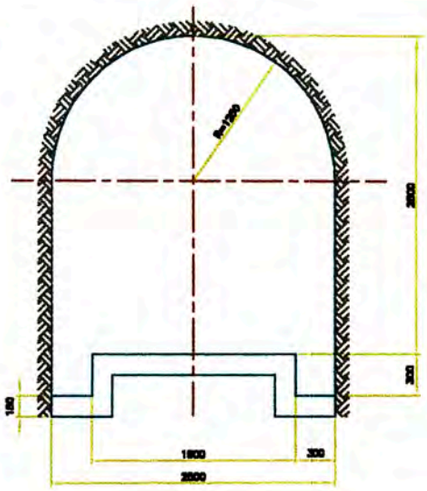


SECTION C
SC. 1/50
EM-08

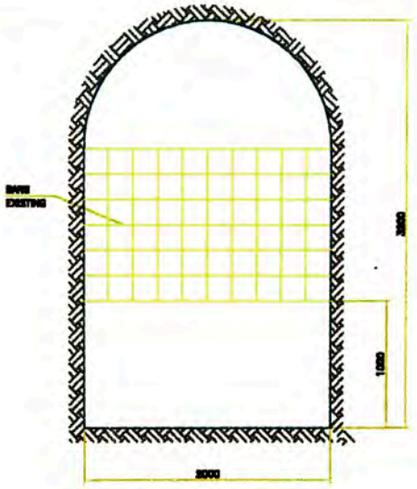
POWER HOUSE



SECTION A
SC. 1/25
EM-08



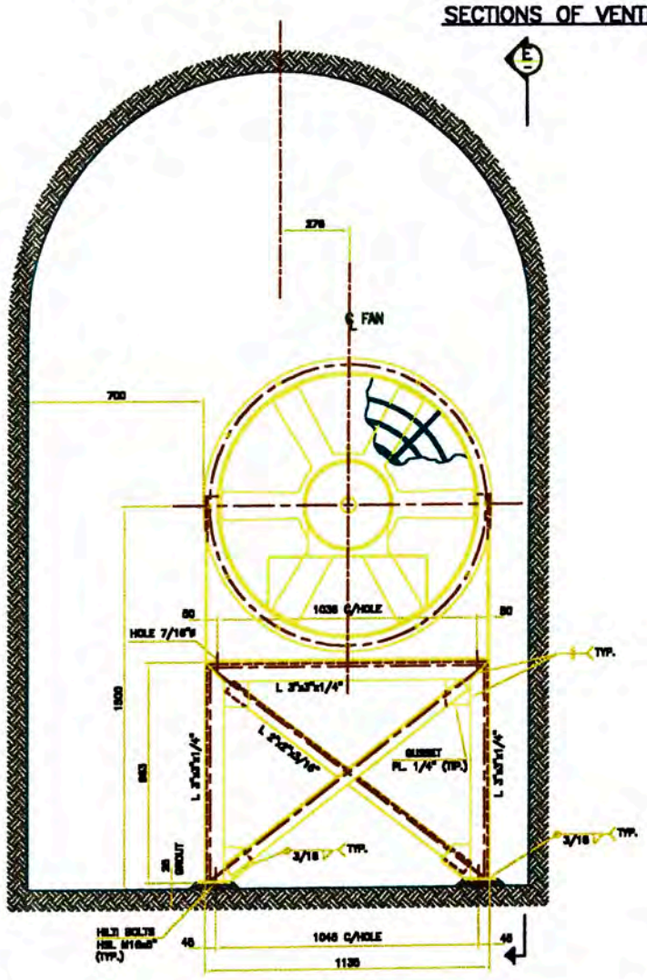
SECTION B
SC. 1/25
EM-08



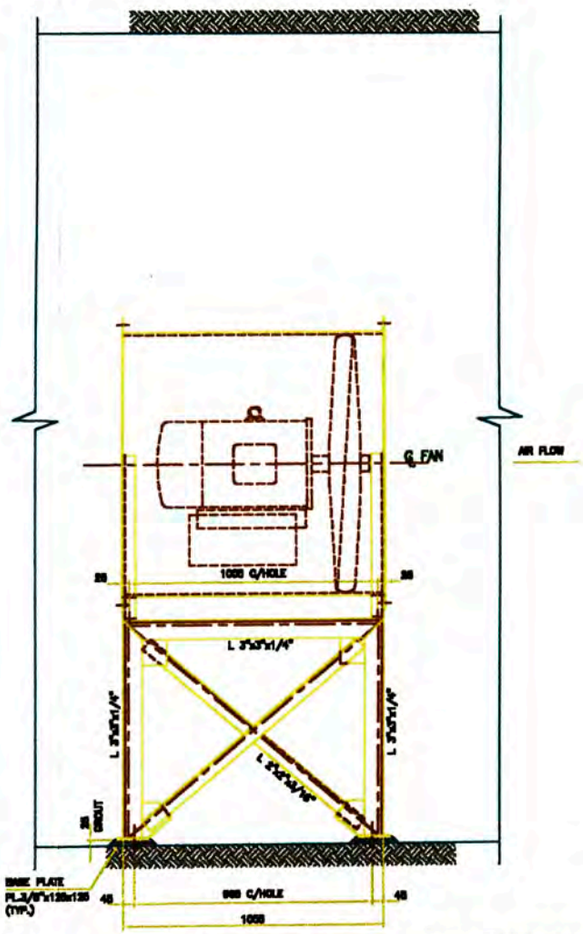
SECTION D
SC. 1/25
EM-08

SECTIONS OF VENTILATION TUNNEL

E



DET. 1
SC. 1/12.5
EM-08



SECTION E
SC. 1/12.5

TRANSFORMER CABLE GALLERY

AS BUILT DRAWING

NOTES:

1.- TRANSFORMER CABLE GALLERY
FAN SPECIFICATION
FLOW = 28,300 CFM
STATIC PRESSURE = 0.61" H_2O
MOTOR = 7.5 HP

2.- FAN MOUNTING AND SUPPORT STRUCTURE ARE ACCORDING TO THE GENERAL DIMENSIONS AND WEIGHT OF THE SUPPLIED FAN

RFERENCE DRAWING

EM-08 POWERHOUSE - VENTILATION SYSTEM - VENT. SYSTEM - GENERAL ARRANGEMENT - PLAN AND SECTIONS
EM-10 Sh1/2 POWERHOUSE - VENTILATION SYSTEM - FAN - GENERAL ARRANGEMENT - PLAN AND SECTIONS

PROJECT CODE: 1388	FILE: EM000310
DESIGNED: F. CUYA R.	DRAWN BY: ALMAGRO/CHEN
CHECKED: F. CUYA R.	
APPROVED: A. CLAVIJO P.	

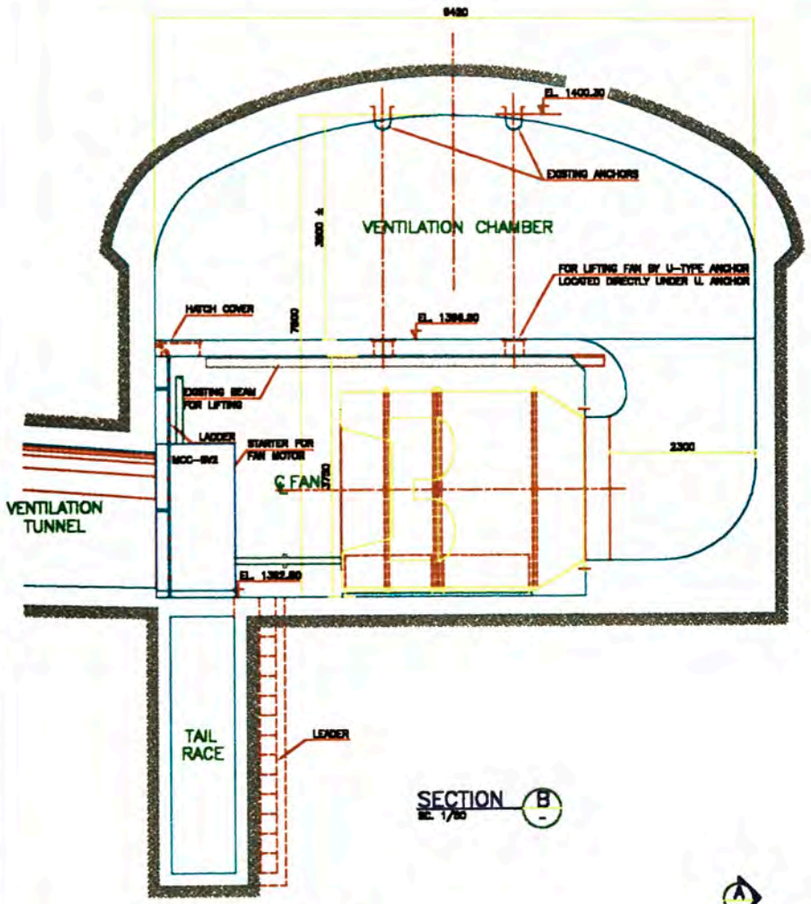
ABB
POWER GENERATION INC.

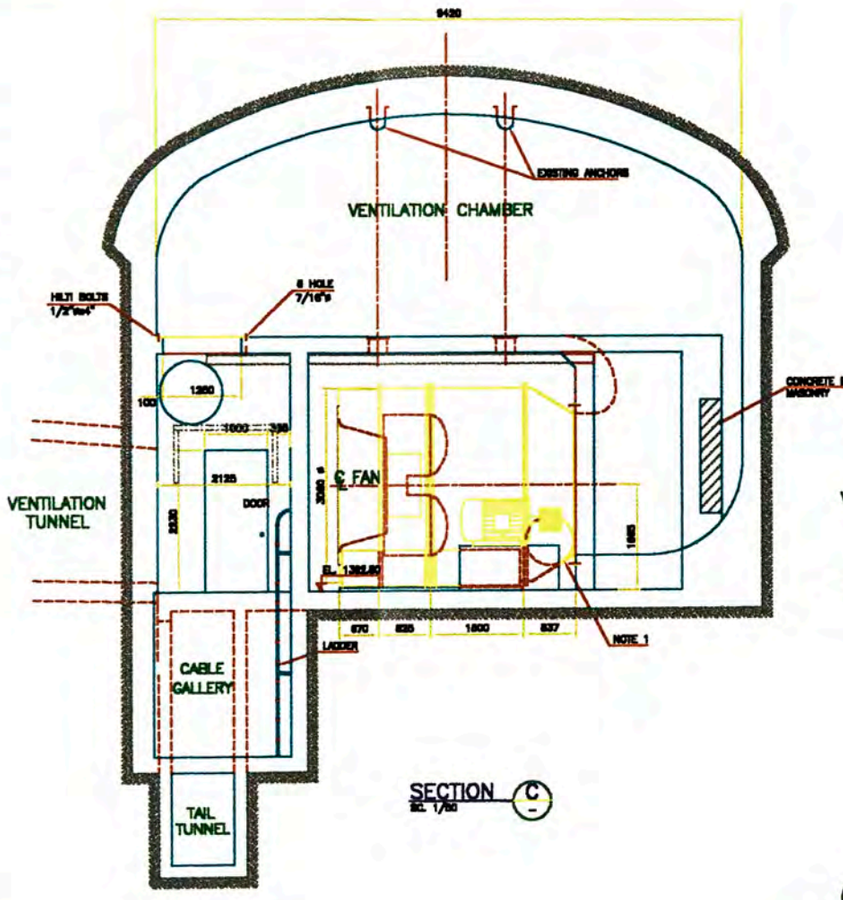
PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CARHUAQUERO DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW

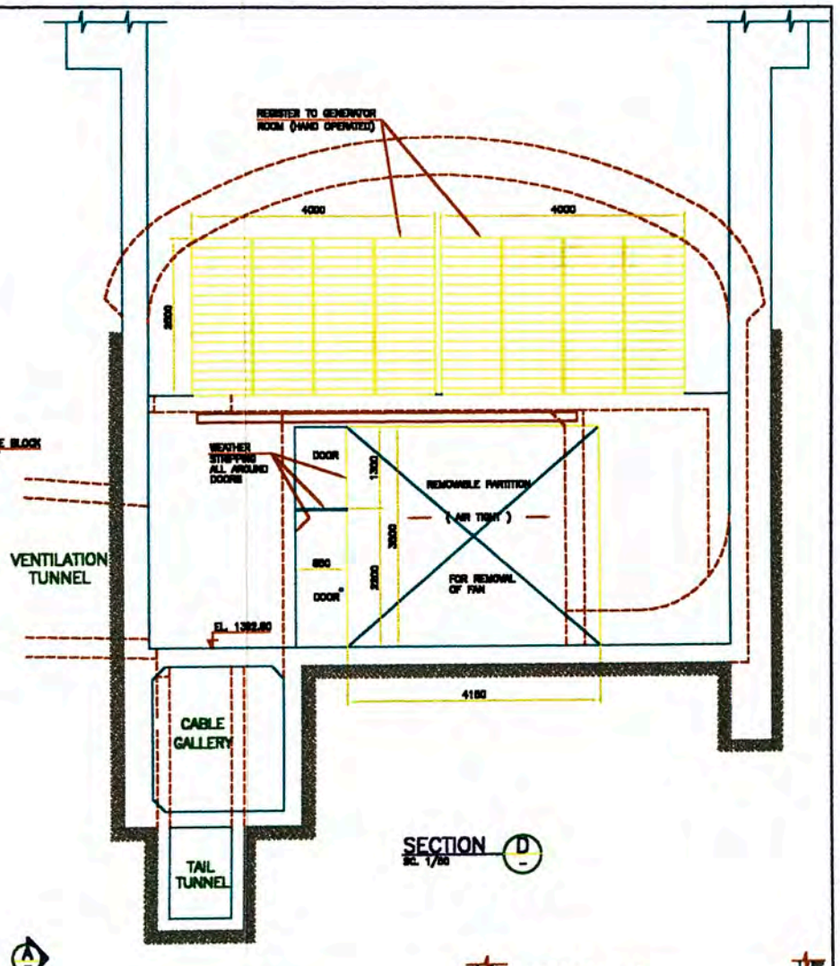
TITLE: POWERHOUSE
FAN GENERAL ARRANGEMENT
PLAN AND SECTIONS

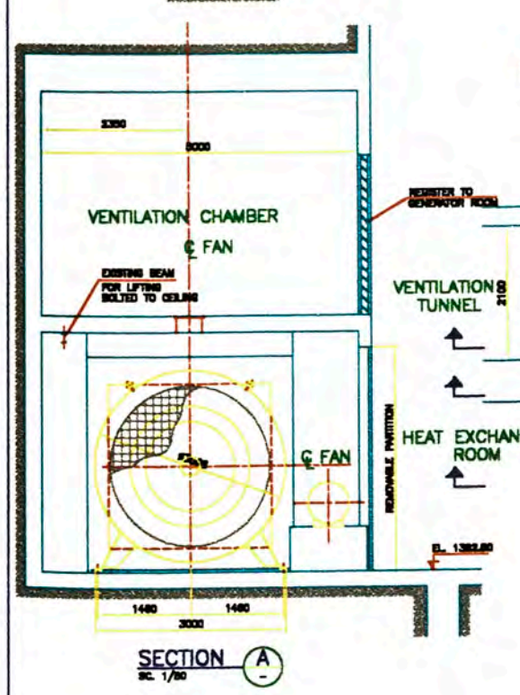
GyM S.A.

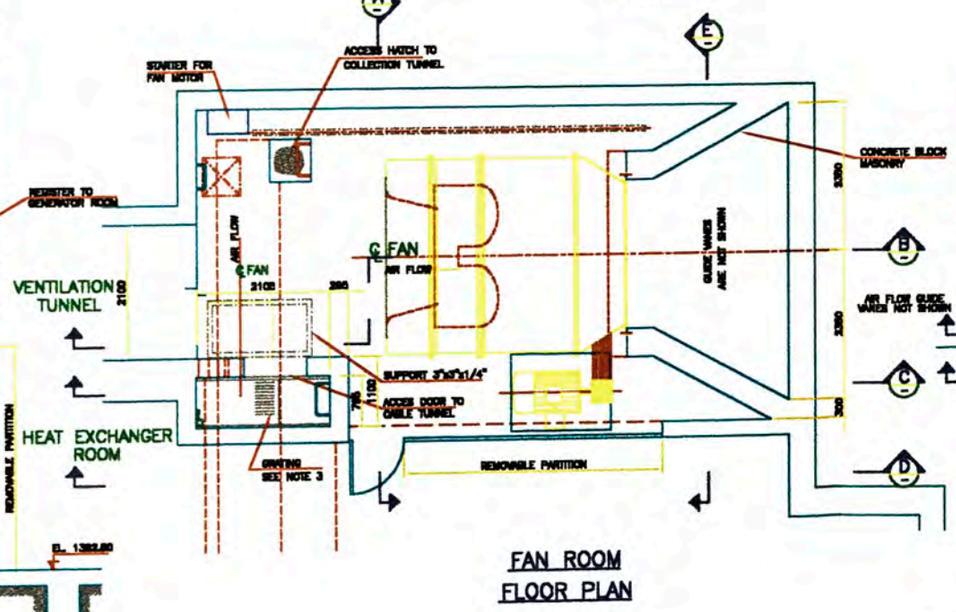
SCALE: IND.	DATE: AUG.'98	DWG. No: EM-10 Sh1/2	REV. No: 1



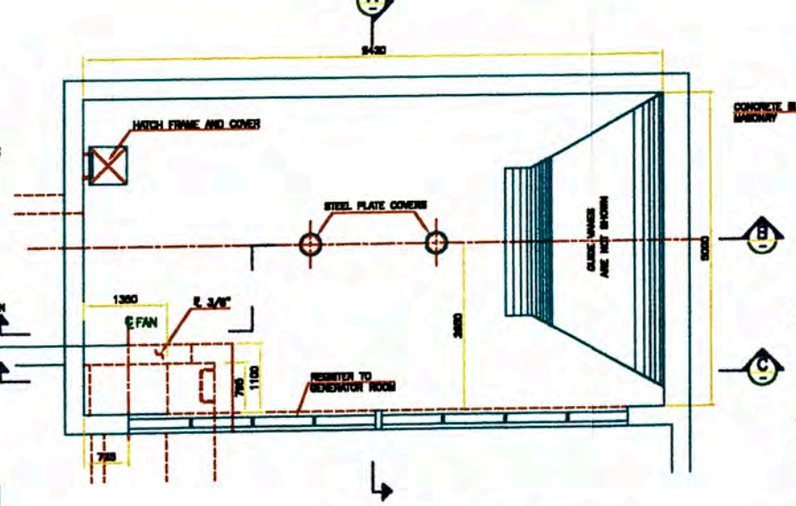




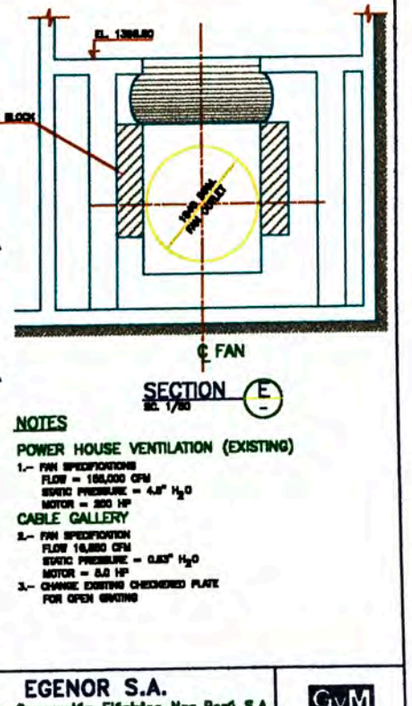




FAN ROOM
FLOOR PLAN



VENTILATION CHAMBER
FLOOR PLAN
(EL. 1396.8)



NOTES

POWER HOUSE VENTILATION (EXISTING)

1.- FAN SPECIFICATIONS
FLOW = 166,000 CFM
STATIC PRESSURE = 4.0" H_2O
MOTOR = 200 HP

CABLE GALLERY

2.- FAN SPECIFICATION
FLOW 16,600 CFM
STATIC PRESSURE = 0.63" H_2O
MOTOR = 5.0 HP

3.- CHANGE EXISTING CHECKERED PLATE FOR OPEN GRATING

AS BUILT DRAWING

REFERENCE DRAWING

EM-08 POWERHOUSE – VENTILATION SYSTEM – VENT. SYSTEM – GENERAL ARRANGEMENT – PLAN AND SECTIONS
EM-10 Sh1/2 POWERHOUSE – VENTILATION SYSTEM – FAN – GENERAL ARRANGEMENT – PLAN AND SECTIONS

PROJECT CODE: 1288	FILE: EM00010A
DESIGNED: J. FERNANDEZ	DRAWING CHECK:
CHECKED: F. CUYA R.	
APPROVED: A. GLAVOE P.	

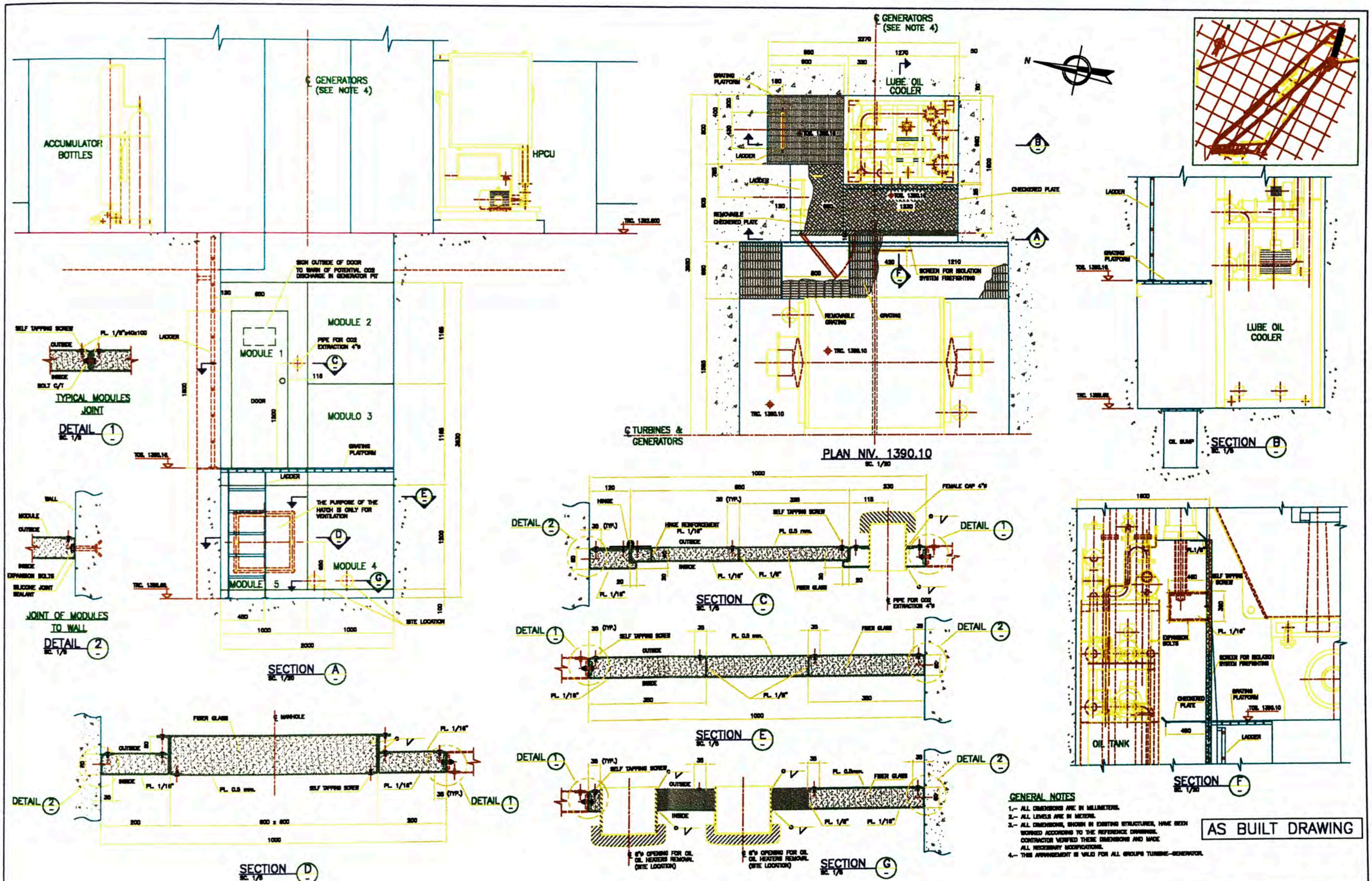
ABB
POWER GENERATION INC.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CARÓN DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

TITLE: POWERHOUSE VENTYLATION SYSTEM
FAN GENERAL ARRANGEMENT
PLAN AND SECTIONS

SCALE: 1/50 | CODE: EM-10 Sh2/2 | REV. No: 1
DATE: AUG.'98

GyM S.A.



GENERAL NOTES

1.– ALL DIMENSIONS ARE IN MILLIMETERS.
2.– ALL LEVELS ARE IN METERS.
3.– ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.– THIS ARRANGEMENT IS VALID FOR ALL GROUPS TURBINE–GENERATOR.

AS BUILT DRAWING

REFERENCE DRAWING

EM–01 POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – PLAN

PROJECT CODE: 1399	FILE: EM000013
DESIGNED: J. FERNANDEZ/VILLANUEVA/T.MERA	DRAWING CHEQ.:
CHECKED: F. CUYA R.	
APPROVED: A. OLAVIDE P.	

ABB POWER GENERATION INC.

GyM S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

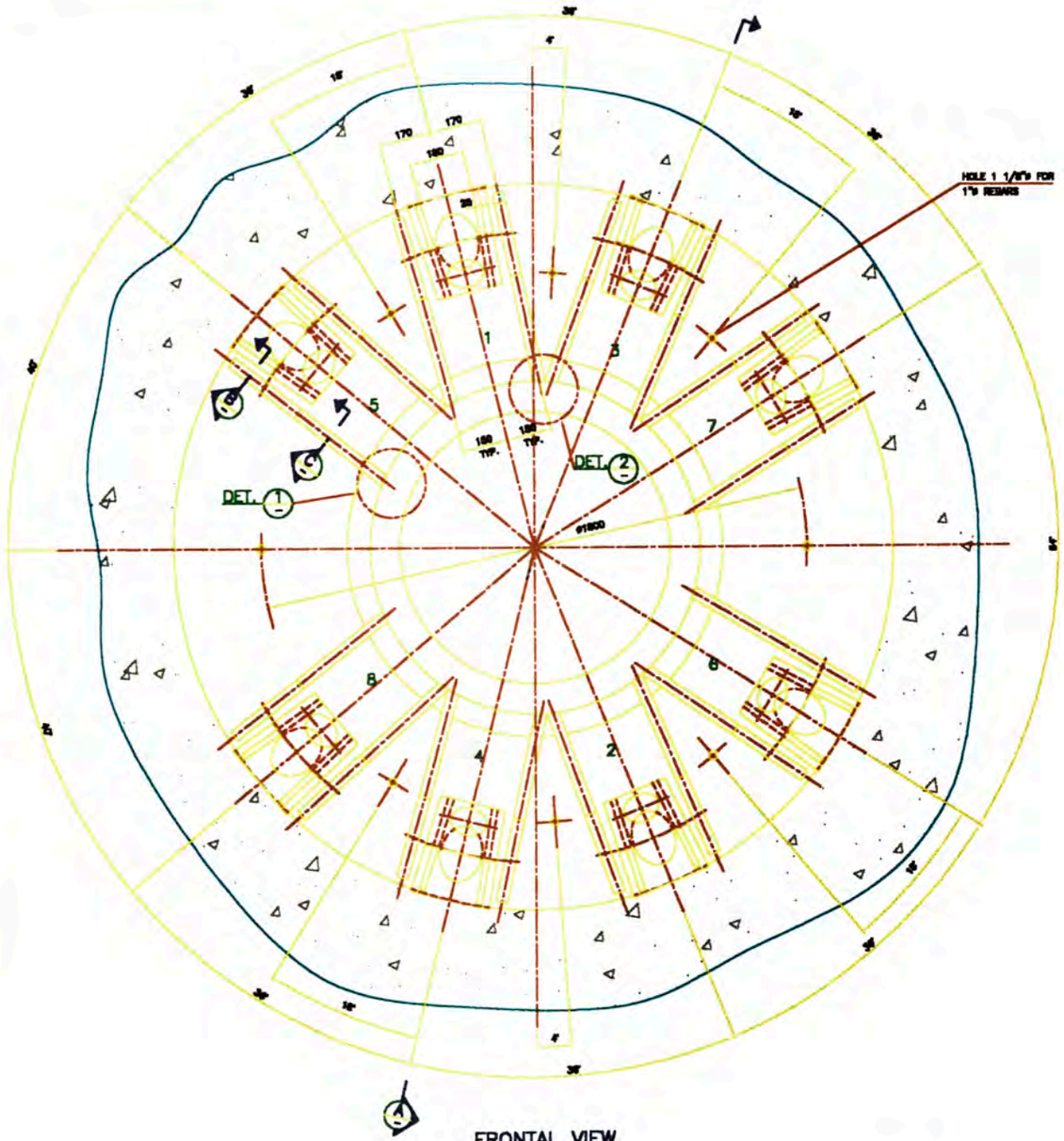
TITLE: TURBINES AND GENERATORS SCREEN FOR ISOLATION SYSTEM FIREFIGHTING

SC.: IND.	CODE: EM–13	REV. No: 2
DATE: AUG.'98		

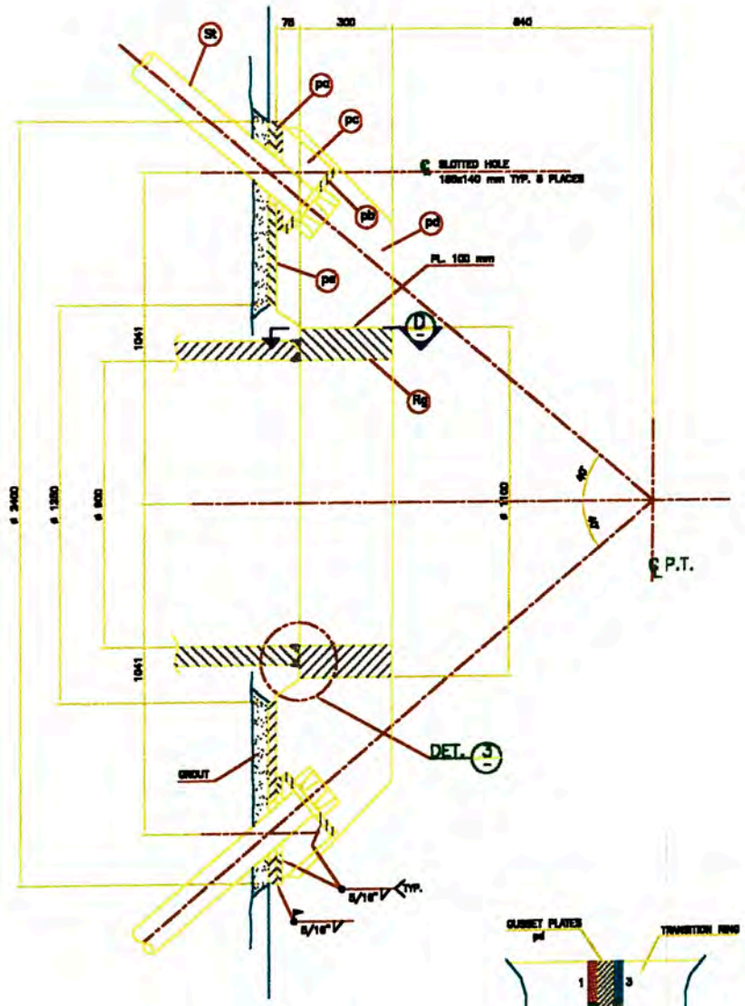
GyM

GyM S.A.

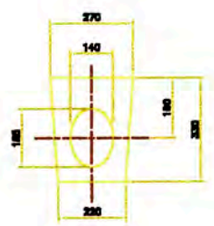
[illegible]



FRONTAL VIEW
SC. 1/10

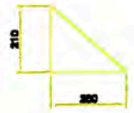


SECTION A
SC. 1/10

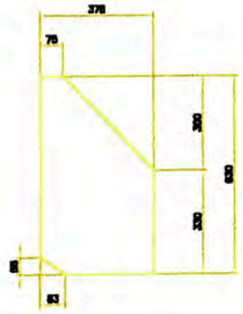


ITEM pa
SC. 1/10

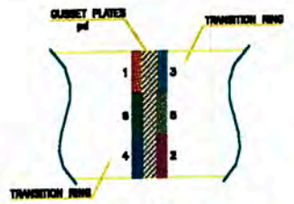
ITEM pb
SC. 1/10



ITEM pc
SC. 1/10



ITEM pd
SC. 1/10



SECTION D
SC. 1/7.5

INSTALLATION PROCEDURE

THE INSTALLATION OF THE EIGHT PRETENSIONING ANCHORS WAS DONE ACCORDING TO THE RECOMENDATIONS OF "ANCHORS INSTALLATION METHODOLOGY" BY SOLEXANCHE BACHY PERU S.A.

STEPS

1.- WELD THE GUSSET PLATES Pd TO THE DISK PLATE Pa IN SHOP.
2.- MAKE IN SHOP THE EIGHT ANCHOR SUPPORTS (USING Pa, Pb & Pc).
3.- FIELD WELD THE TRANSITION RING TO THE PENSTOCK.
4.- INSTALL THE DISK PLATE Pa AS A DRILLING JIG TO LOCATE THE DRILLING POINTS ON THE ROCK.
5.- TEMPORARILY SECURE DISK PLATE TO ROCK WITH 1"ø REBARS GROUT DISK PLATE.
6.- EXECUTE THE DRILLING AND THE INSTALLATION OF THE STRANDS IN THE ROCK.
7.- EXECUTE THE STRAND ANCHORS TENSIONING.
8.- FIELD WELD THE GUSSET PLATES TO THE TRANSITION RING.

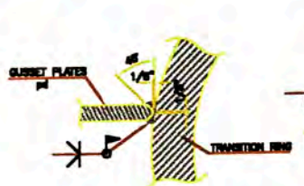
NOTES :

1.- ALL THE DIMENSIONS ARE IN MILLIMETERS.
2.- WELDING WAS ACCORDING TO AWS OR ASME, AND Gyd's WELDING PROCEDURES.
3.- THE TOTAL FORCE EACH ANCHOR IS 88 TON.
4.- FOR DETAILS OF TRANSITION RING SEE THE KNAERNER DRAWING 2000000.
5.- MAGNETIC PARTICLE TEST WAS PERFORMED BETWEEN THE GUSSET PLATE AND THE TRANSITION RING; ULTRASONIC AND INK PENETRANTS TEST WAS PERFORMED BETWEEN THE EXISTING PENSTOCK AND TRANSITION RING.

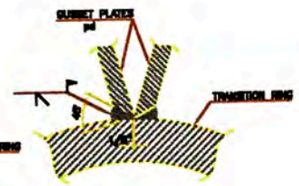
AS BUILT DRAWING

TAKE OFF

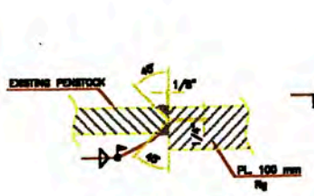
ITEM	DESCRIPTION	QTY.	MATERIAL	OBSERVATIONS
pa	PLATE 3/4"x270x330	8	A36	
pb	PLATE 3/4"x348x250	8	A36	
pc	PLATE 3/4"x210x250	16	A36	
pd	PLATE 1 1/2"x378x630	16	A36	
pe	RING 1"x#128DINT.x#340DEXT.	1	A36	
St	STRAND ANCHORS	8		
Rg	TRANSITION RING	1	FORGED 20 MnS	SUPPLIED BY KNAERNER



DETAIL 1
SC. 1/7.5 TYP.

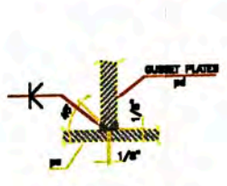


DETAIL 2
SC. 1/7.5



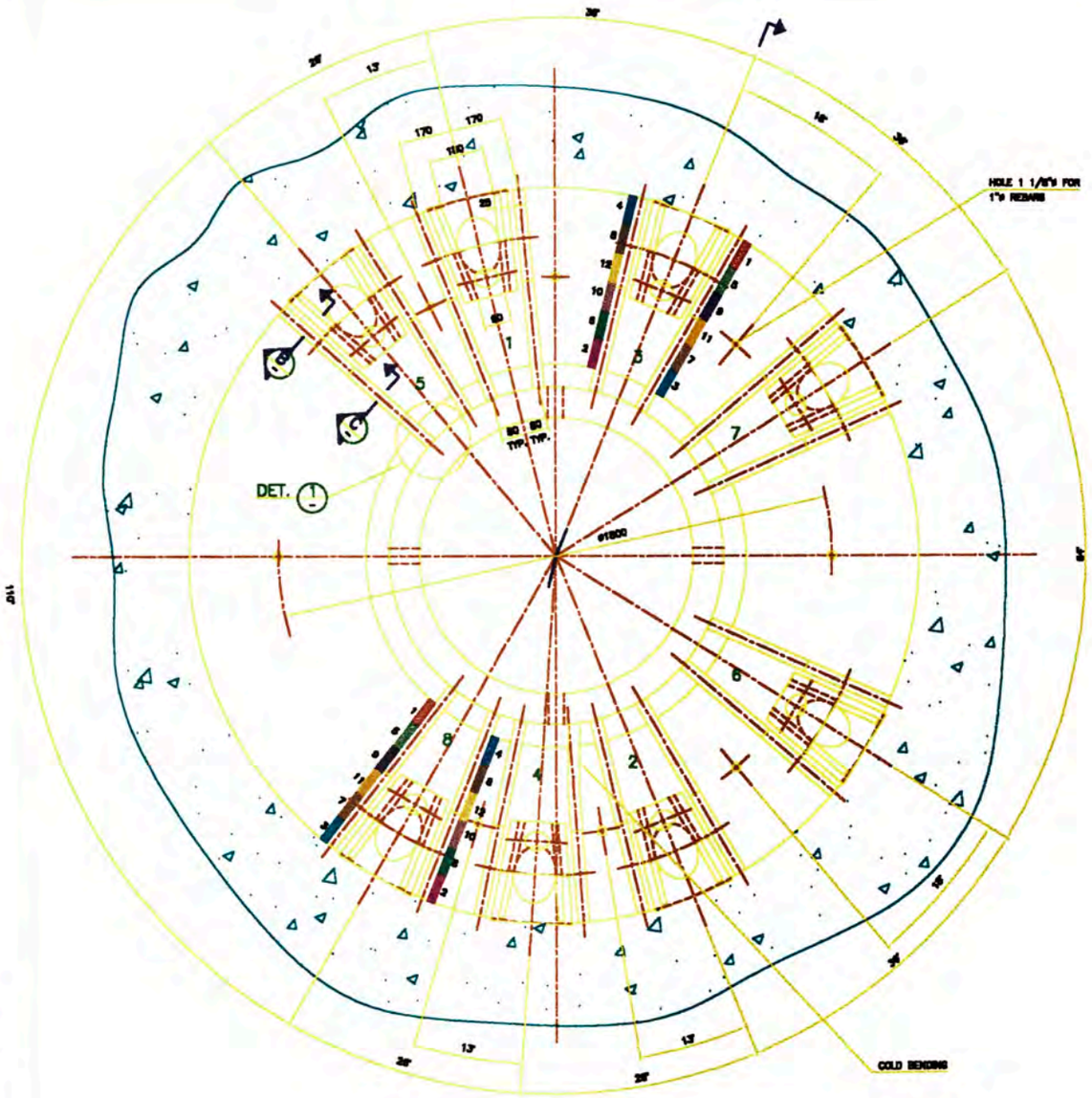
DETAIL 3
SC. 1/7.5

SECTION B
SC. 1/7.5 TYP.



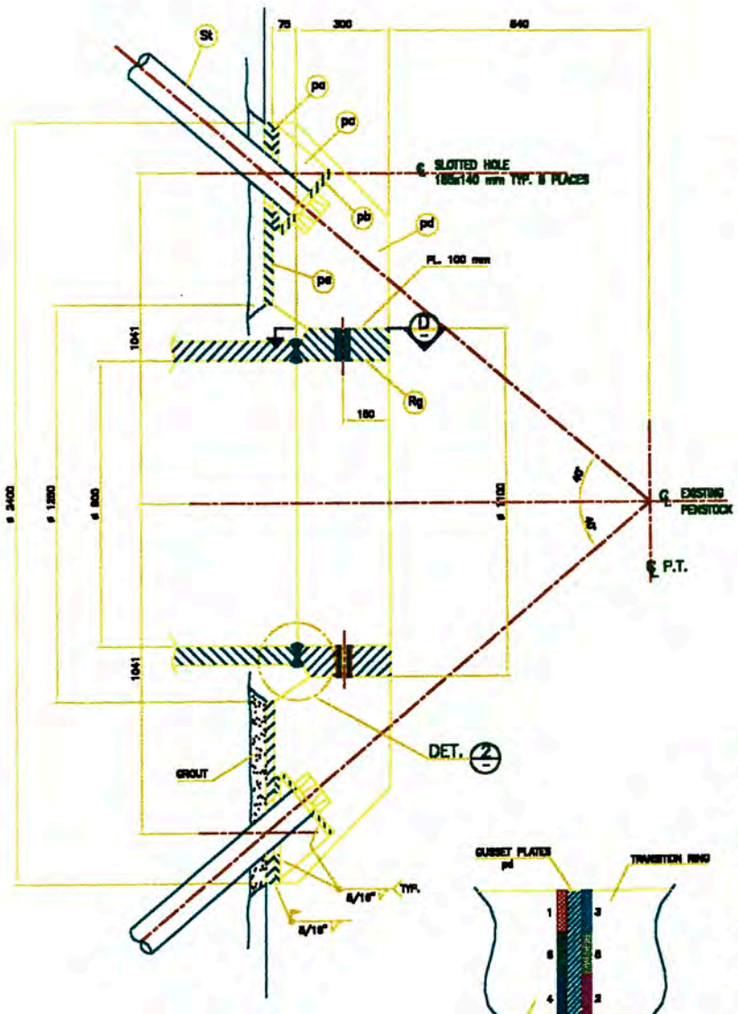
SECTION C
SC. 1/7.5 TYP.

PROJECT CODE: 1289	FILE: EM000014	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW
DESIGNED: C. NUÑEZ M.	DRAWING CHG.:		TITLE: PENSTOCK RING UNITS 6A, 5A, 5B, 4A, 4B, 3A, 3B, 2A, 2B, 1A &1 B
CHECKED: F. OLIVA R.			SCL: IND. DATE: AUG.'00 CODE: EM-14 Sh1/2 REV. No: 1
APPROVED: A. CLAVIJO P.			GyM S.A.



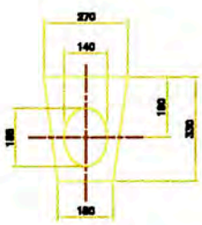
A

FRONTAL VIEW
ONLY FOR 6B
SC. 1/10

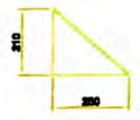


SECTION A
SC. 1/10

SECTION D
SC. 1/7.5

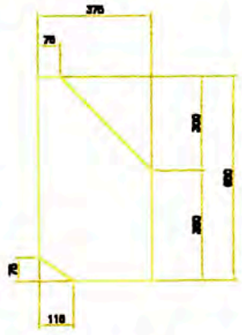


ITEM pa
SC. 1/10



ITEM pc
SC. 1/10

ITEM pb
SC. 1/10



ITEM pd
SC. 1/10

INSTALLATION PROCEDURE

THE INSTALLATION OF THE EIGHT PRETENSIONING ANCHORS WAS DONE ACCORDING TO THE RECOMENDATIONS OF "ANCHORS INSTALLATION METHODOLOGY" BY SOLETANCHE BACHY PERU S.A.

STEPS

1.- FIX THE PLATE RING (Pe) WITH EIGHT 1"ø REBARS
2.- FILL WITH GROUT THE PLATE RING (Pe)
3.- EXECUTE THE PRETENSIONING STRAND ANCHORS
4.- THE TRANSITION RING (Rg) WAS WELDED AFTER FINISHED THE PRETENSIONING PROCESS.
5.- THE GUSSET PLATE (Pd) WAS WELDED IN ALTERNATED SEQUENCE TO AVOID WARPING. (1 TO 8)

NOTES :

1.- ALL THE DIMENSIONS ARE IN MILLIMETERS.
2.- WELDING WAS ACCORDING TO AWS OR ASME.
3.- THE TOTAL FORCE EACH ANCHOR IS 68 TON.
4.- FOR DETAILS OF TRANSITION RING SEE THE MARINER DRAWING 30666B.
5.- MAGNETIC PARTICLE TESTS WAS PERFORMED ON CRITICAL WELDS.

A.- RING PLATE

1.- ROOM TEMPERATURE.
2.- USE ELECTRODE E7018.
3.- WELDING WAS DONE SEQUENCIALLY IN ALTERNATED SEGMENTS OF 50 mm.
4.- CHECK DISTORTIONS.
5.- WHEN NO DISTORTIONS INCREASE THE FINISHING WELD SEGMENT WAS INCREASED TO 100 mm.

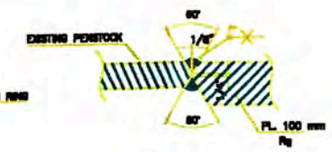
B.- TRANSITION PLATE

1.- PREHEATING IN A RATE OF 60°C TO 100°C WAS USED.
2.- ELECTRODE E7018 WAS USED.
3.- SLOW COOLING WAS USED.

C.- RING-PENSTOCK

1.- PROCEDURE AS B.
2.- ULTRASONIC TEST WAS PERFORMED ON CRITICAL WELDS.
3.- INK PENETRATING TEST TO ROOT STEP WAS PERFORMED.

DETAIL 1
SC. 1/7.5 TYP.



DETAIL 2
SC. 1/7.5

SECTION B
SC. 1/7.5 TYP.

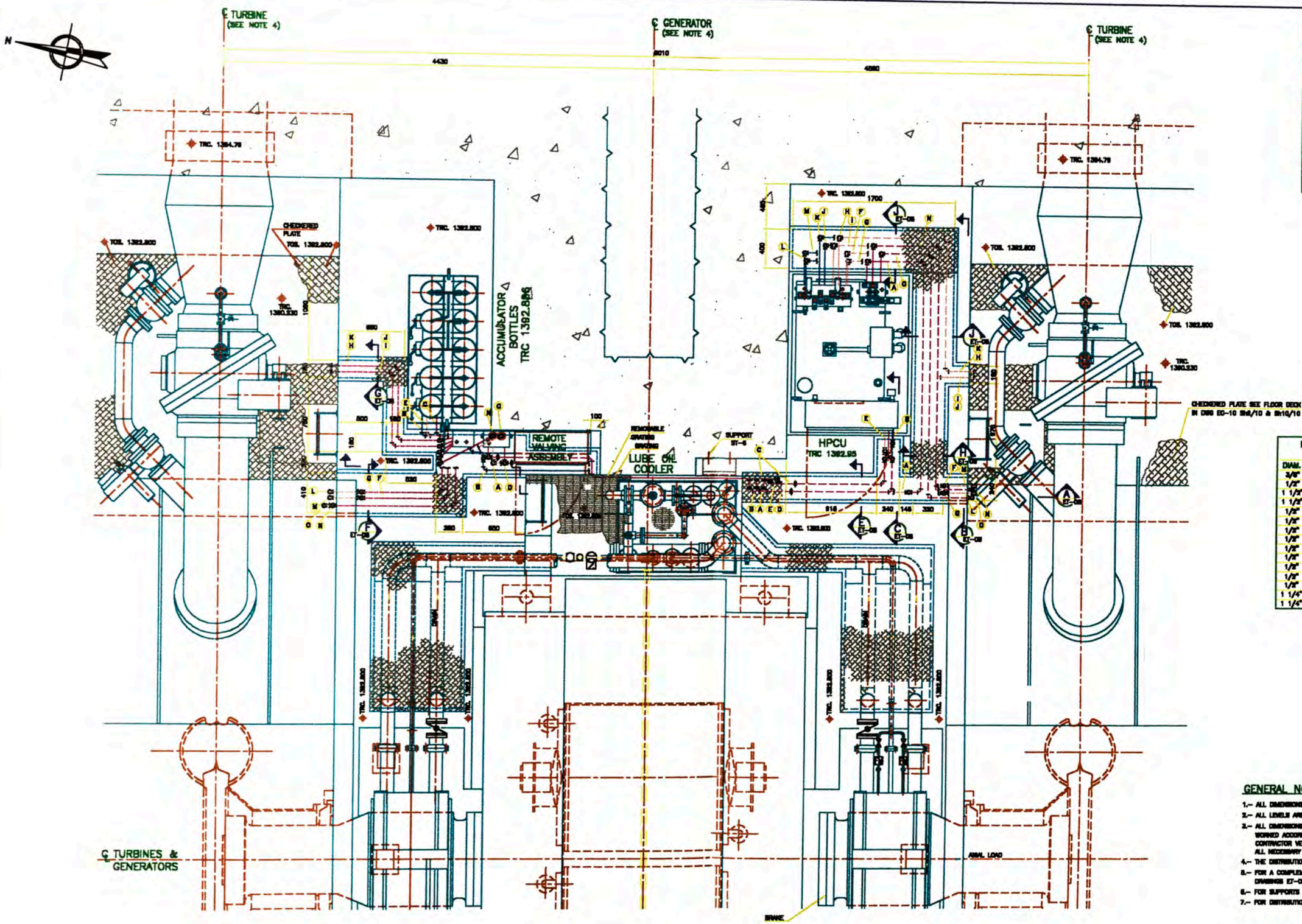
SECTION C
SC. 1/7.5 TYP.

TAKE OFF

ITEM	DESCRIPTION	QTY.	MATERIAL	OBSERVATIONS
pa	PLATE 3/4"x270x330	8	A36	
pb	PLATE 3/4"x330x660	8	A36	
pc	PLATE 3/4"x210x250	16	A36	
pd	PLATE 1 1/2"x370x660	16	A36	
pe	RING 1"ø1280INT.ø2400EXT.	1	A36	
St	STRAND ANCHORS	8		
Rg	TRANSITION RING	1	FORGED 20 MoS	SUPPLIED BY MARINER

AS BUILT DRAWING

PROJECT CODE: 1389	FILE: EM00014A	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW
DESIGNED: C. NUÑEZ	DRAWING CKD.:		TITLE: PENSTOCK RING UNIT 6B
CHECKED: F. CUYA			GyM S.A.
APPROVED: A. CLAVIJE			SCL: INCL. DWG: EM-14 Sh2/2 REV. No: 1



PIPING CODES OF HYDRAULIC CONTROL		
DIAM.	NAME	COD.
3/8"	VENT	A
1/2"	INLET VALVE PRESSURE	B
1 1/2"	MAIN SYSTEM PRESSURE	C
1 1/2"	TANK	D
1/2"	DRAIN	E
1/2"	INJECTOR CLOSE	F
1/2"	INJECTOR OPEN	G
1/2"	INLET CLOSE	H
1/2"	INLET OPEN	I
1/2"	INLET CLOSE	J
1/2"	INLET OPEN	K
1/2"	INJECTOR CLOSE	L
1/2"	INJECTOR OPEN	M
1 1/4"	DEFLECTOR CLOSE	N
1 1/4"	DEFLECTOR OPEN	O

GENERAL NOTES

1.– ALL DIMENSIONS ARE IN MILLIMETERS.
2.– ALL LEVELS ARE IN METERS.
3.– ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.– THE DISTRIBUTION OF TUBING AND PIPE IS VALID FOR ALL GROUPS (1 TO 8).
5.– FOR A COMPLEMENTARY INFORMATION SEE THE ISOMETRIC DRAWINGS ET–08 Sh1 TO 3.
6.– FOR SUPPORTS SEE DRAWING ET–31 Sh1 & 2.
7.– FOR DISTRIBUTION OF SUPPORTS SEE DRAWING ET–32 Sh1, 2 & 3.

AS BUILT DRAWING

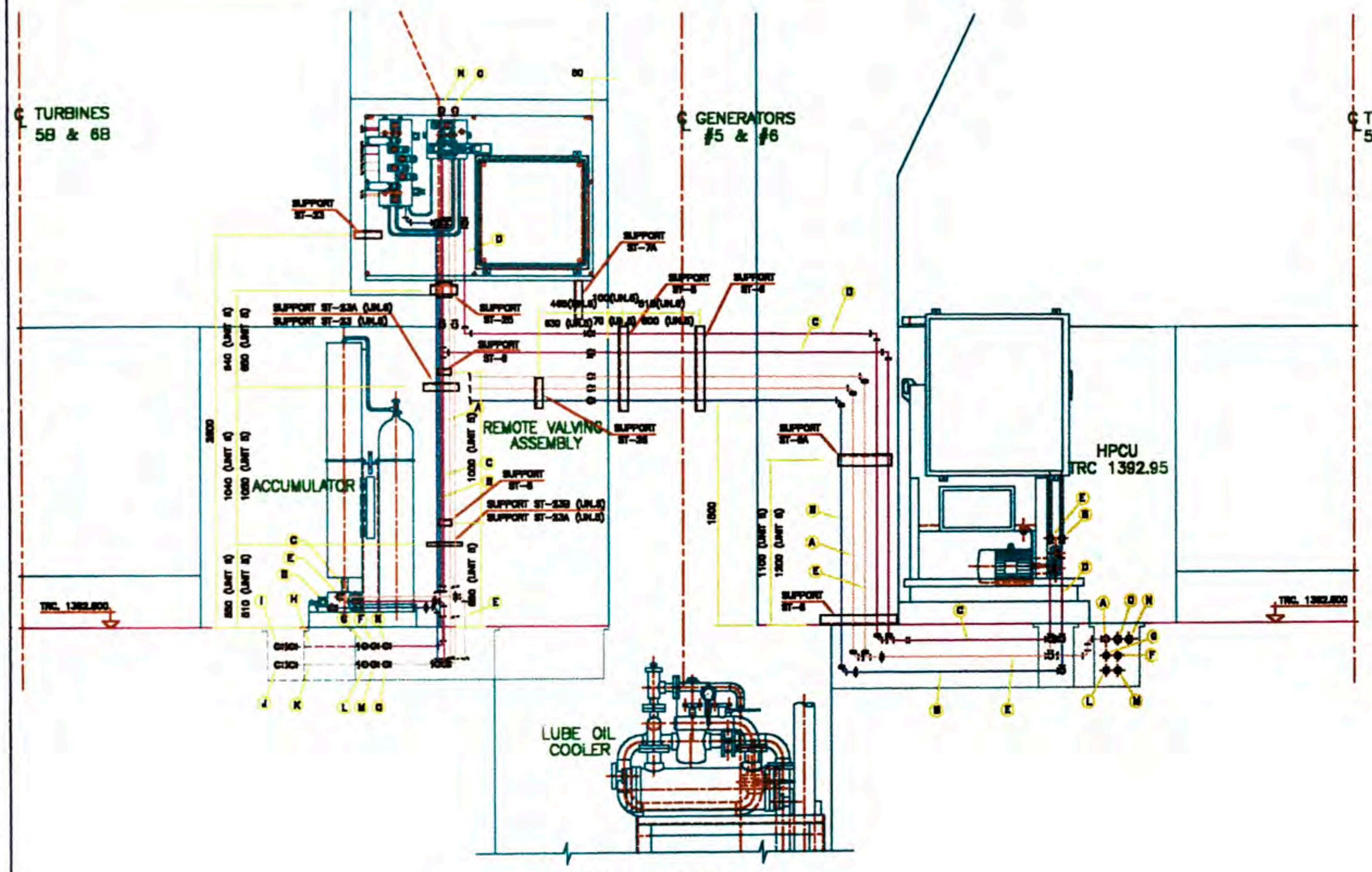
PLAN EL. 1392.80

REFERENCE DRAWING

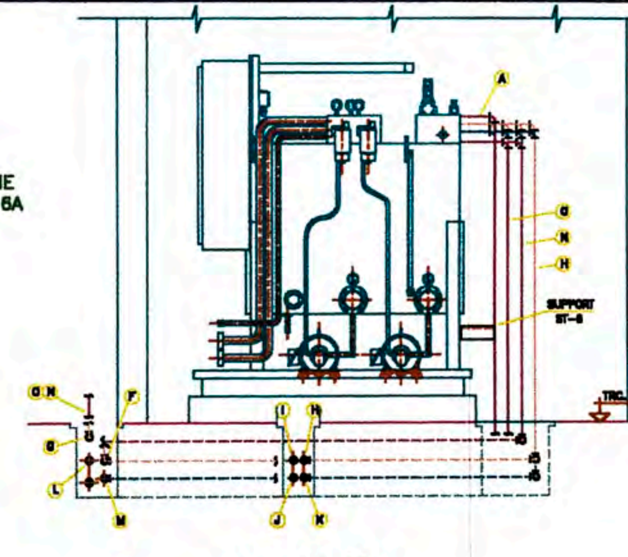
EM–01	POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – PLAN
ET–08	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PIPING – SECTIONS
ET–31 Sh1 & 2	STANDARDS OF SUPPORT
ET–32 Sh1/3	POWERHOUSE – GENERATORS N°5 & N°6 – DISTRIBUTION SUPPORTS
ET–32 Sh1/3	POWERHOUSE – GENERATORS N°3 & N°4 – DISTRIBUTION SUPPORTS
ET–32 Sh1/3	POWERHOUSE – GENERATORS N°1 & N°2 – DISTRIBUTION SUPPORTS

PROJECT CODE: 1289	FILE: ET0000007	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: E. VERAS	DRAWING CHK.:		TITLE: TURBINES AND GENERATORS HYDRAULIC POWER CONTROL UNIT PLAN
CHECKED: F. CUYA R.			SCL: 1/20
APPROVED: A. GLANCE P.			DATE: AUG.'99
			CODE: ET–07
			REV. No: 1

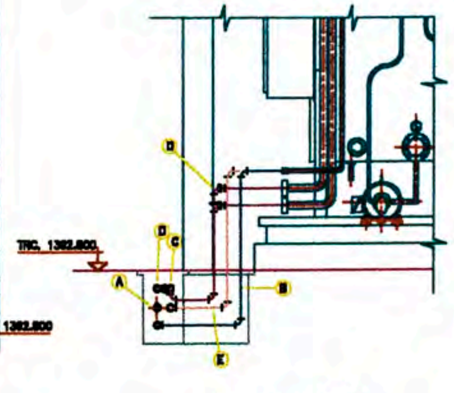
GyM S.A.



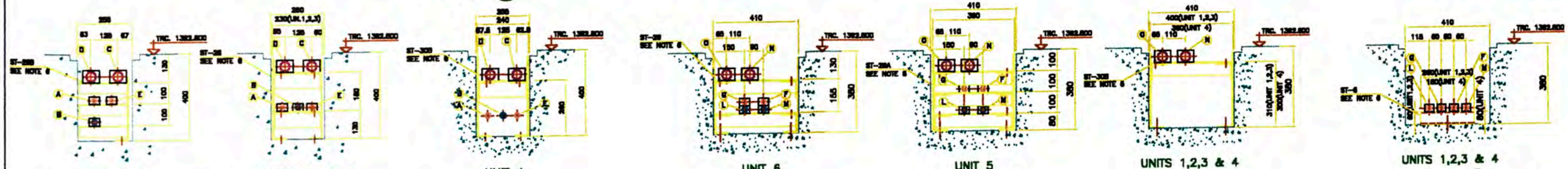
SECTION A
SC. 1/20



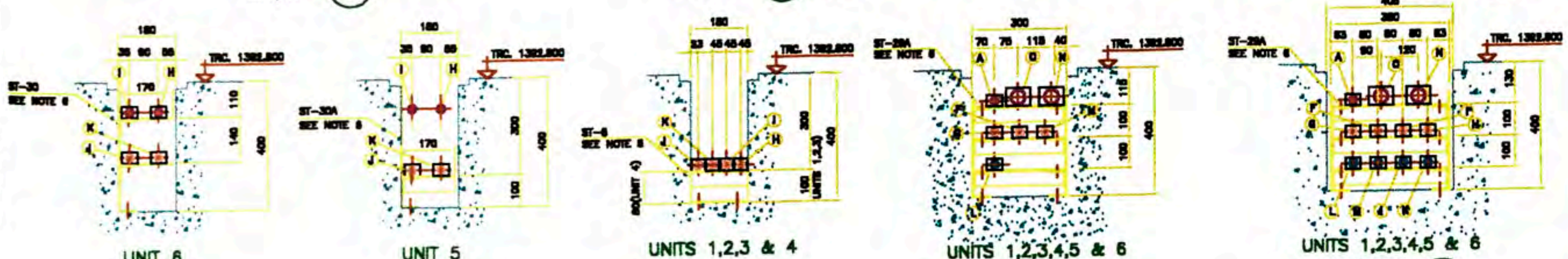
SECTION B
SC. 1/20



SECTION C
SC. 1/20



SECTION E SC. 1/10 — SECTION E' SC. 1/10 — SECTION F SC. 1/10 — SECTION F' SC. 1/10



SECTION G SC. 1/10 — SECTION H SC. 1/10 — SECTION J SC. 1/10

PIPING CODES OF HYDRAULIC CONTROL

DIAM.	NAME	COD.
3/8"	VENT	A
1/2"	INLET VALVE PRESSURE	B
1 1/2"	MAIN SYSTEM PRESSURE	C
1 1/2"	TANK	D
1/2"	DRAIN	E
1/2"	INJECTOR CLOSE	F
1/2"	INJECTOR OPEN	G
1/2"	INLET CLOSE	H
1/2"	INLET OPEN	I
1/2"	INLET CLOSE	J
1/2"	INLET OPEN	K
1/2"	INJECTOR CLOSE	L
1/2"	INJECTOR OPEN	M
1 1/4"	DEFLECTOR CLOSE	N
1 1/4"	DEFLECTOR OPEN	O

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- THE DISTRIBUTION OF TUBING AND PIPE IS VALID FOR ALL GROUPS (1 TO 6).
5.- FOR COMPLEMENTARY INFORMATION SEE THE ISOMETRIC DRAWINGS ET-08 Sh1 TO 3.
6.- FOR SUPPORTS SEE DRAWINGS ET-31 Sh 1 & 2.

AS BUILT DRAWING

REFERENCE DRAWING

ET-07 TURBINES AND GENERATORS HYDRAULIC POWER CONTROL UNIT – PIPING – PLAN
ET-31 Sh1 & 2 STANDARDS OF SUPPORT

PROJECT CODE: 1288	FILE: ET000008
DESIGNED: E. VEGAS	DRAWING CAD: [illegible]
CHECKED: F. OLIVA	
APPROVED: A. OLAVIDE	

ABB
POWER GENERATION INC.

GyM S.A.

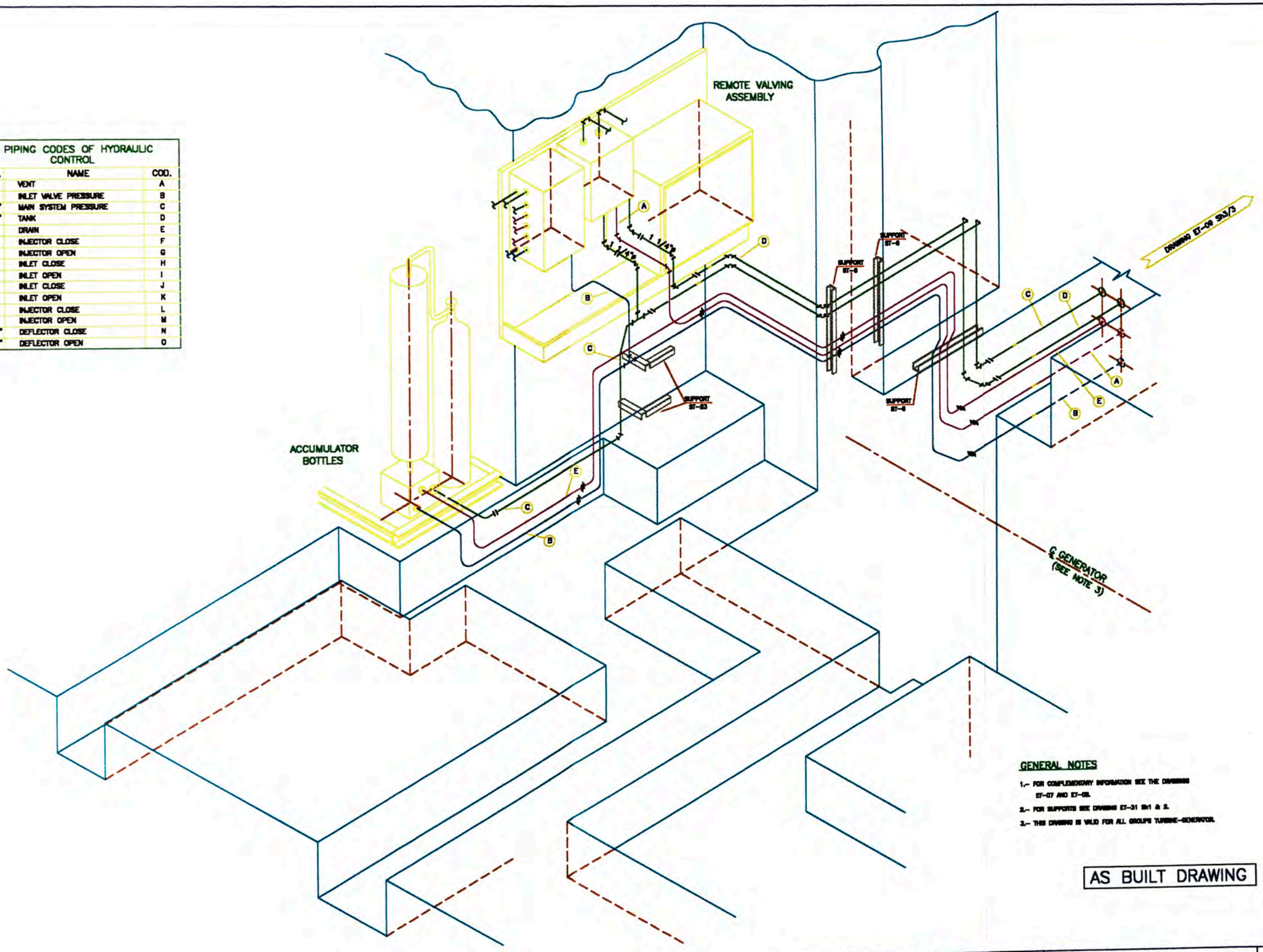
PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

TITLE: TURBINES AND GENERATORS HYDRAULIC POWER CONTROL UNIT–PIPING SECTIONS

SCALE: IND. DATE: AUG.'98 CODE: ET–08 REV. No 1

GyM
GyM S.A.

PIPING CODES OF HYDRAULIC CONTROL		
DIAM.	NAME	COD.
3/8"	VENT	A
1/2"	INLET VALVE PRESSURE	B
1 1/2"	MAIN SYSTEM PRESSURE	C
1 1/2"	TANK	D
1/2"	DRAIN	E
1/2"	INJECTOR CLOSE	F
1/2"	INJECTOR OPEN	G
1/2"	INLET CLOSE	H
1/2"	INLET OPEN	I
1/2"	INLET CLOSE	J
1/2"	INLET OPEN	K
1/2"	INJECTOR CLOSE	L
1/2"	INJECTOR OPEN	M
1 1/4"	DEFLECTOR CLOSE	N
1 1/4"	DEFLECTOR OPEN	O



GENERAL NOTES

1.- FOR COMPLEMENTARY INFORMATION SEE THE DRAWINGS ET-07 AND ET-08.

2.- FOR SUPPORTS SEE DRAWING ET-31 Sh1 & 2.

3.- THIS DRAWING IS VALID FOR ALL GROUPS TURBINE-GENERATOR.

AS BUILT DRAWING

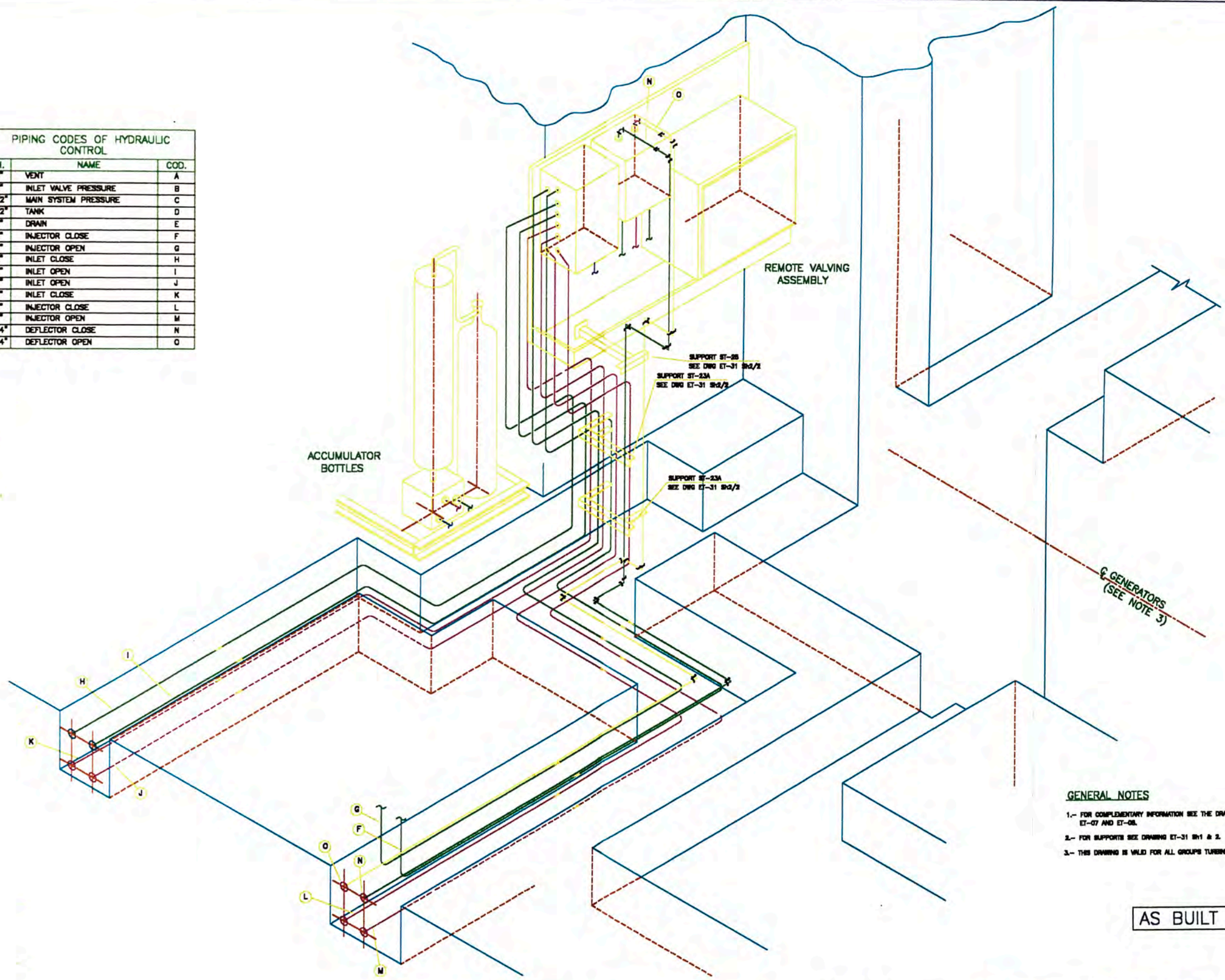
REFERENCE DRAWING

ET-07	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PLAN
ET-31 Sh1 & 2	STANDARDS OF SUPPORT

PROJECT CODE: 1269	FILE: ET000009	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CARHUAQUERO DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: E. VEGAS	DRAWING CHECKED: [illegible]		TITLE: TURBINES AND GENERATORS HYDRAULIC POWER CONTROL UNIT–PIPING ISOMETRIC
CHECKED: F. CUYA R.			SCALE: N/S DATE: AUG.'98
APPROVED: A. OLAVIDE P.			CODE: ET–09 Sh1/3 REV. No: 1

GyM S.A.

PIPING CODES OF HYDRAULIC CONTROL		
DIAM.	NAME	COD.
3/8"	VENT	A
1/2"	INLET VALVE PRESSURE	B
1 1/2"	MAIN SYSTEM PRESSURE	C
1 1/2"	TANK	D
1/2"	DRAIN	E
1/2"	INJECTOR CLOSE	F
1/2"	INJECTOR OPEN	G
1/2"	INLET CLOSE	H
1/2"	INLET OPEN	I
1/2"	INLET OPEN	J
1/2"	INLET CLOSE	K
1/2"	INJECTOR CLOSE	L
1/2"	INJECTOR OPEN	M
1 1/4"	DEFLECTOR CLOSE	N
1 1/4"	DEFLECTOR OPEN	O



GENERAL NOTES

1.- FOR COMPLEMENTARY INFORMATION SEE THE DRAWINGS ET-07 AND ET-08.

2.- FOR SUPPORTS SEE DRAWING ET-31 Sh1 & 2.

3.- THIS DRAWING IS VALID FOR ALL GROUPS TURBINE-GENERATOR.

AS BUILT DRAWING

REFERENCE DRAWING

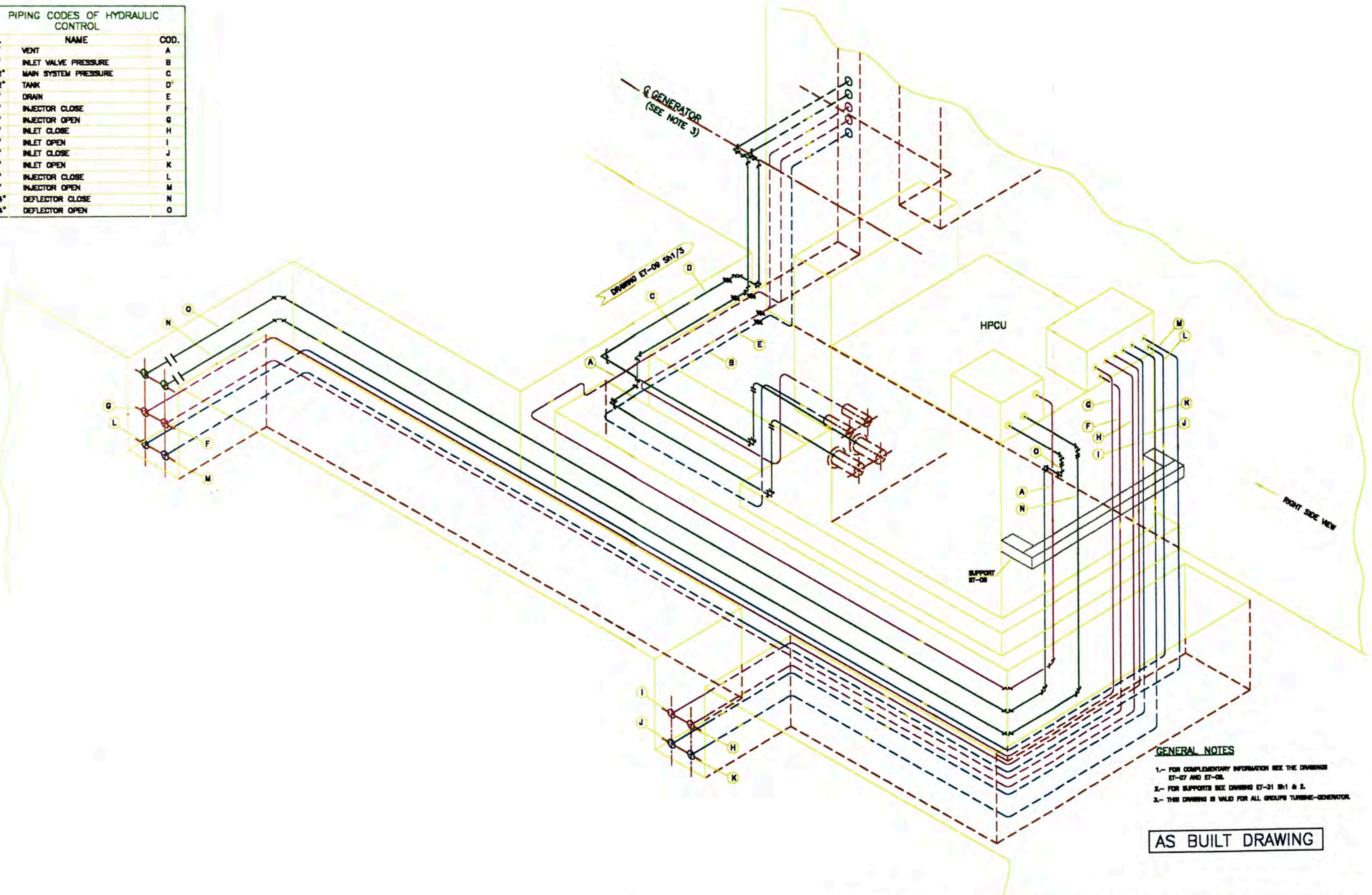
ET-07 TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PLAN
ET-31 Sh1 & 2 STANDARDS OF SUPPORT

PROJECT CODE: 1288	FILE: ET0009A	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: E. VEGAS	DRAWING CHCK:		TITLE: TURBINES AND GENERATORS HYDRAULIC POWER CONTROL UNIT–PIPING ISOMETRIC
CHECKED: F. CUYA			SCL: S/N
APPROVED: A. OLAVIDE			DATE: AUG.'98
			CODE: ET–09 Sh2/3
			REV. No: 1

GyM S.A.

PIPING CODES OF HYDRAULIC CONTROL

DIAM.	NAME	COD.
3/8"	VENT	A
1/2"	INLET VALVE PRESSURE	B
1 1/2"	MAIN SYSTEM PRESSURE	C
1 1/2"	TANK	D
1/2"	DRAIN	E
1/2"	INJECTOR CLOSE	F
1/2"	INJECTOR OPEN	G
1/2"	INLET CLOSE	H
1/2"	INLET OPEN	I
1/2"	INLET CLOSE	J
1/2"	INLET OPEN	K
1/2"	INJECTOR CLOSE	L
1/2"	INJECTOR OPEN	M
1 1/4"	DEFLECTOR CLOSE	N
1 1/4"	DEFLECTOR OPEN	O



GENERAL NOTES

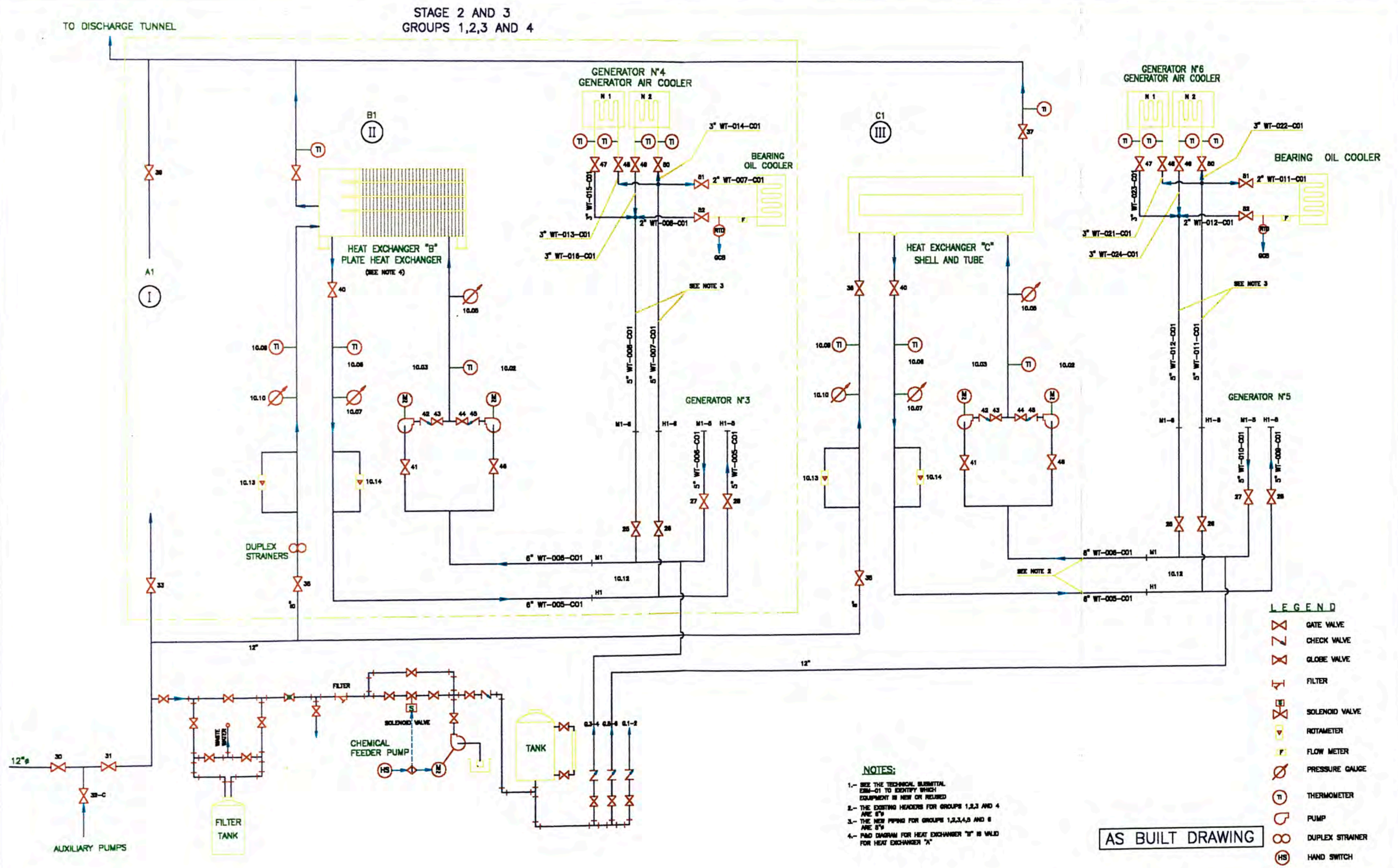
1.- FOR COMPLEMENTARY INFORMATION SEE THE DRAWINGS ET-07 AND ET-08.
2.- FOR SUPPORTS SEE DRAWING ET-31 Sh1 & 2.
3.- THIS DRAWING IS VALID FOR ALL GROUPS TURBINE-GENERATOR.

AS BUILT DRAWING

REFERENCE DRAWING

ET-07 TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PLAN
ET-31 Sh1 & 2 STANDARDS OF SUPPORT

PROJECT CODE: 1298	FILE: ET00009B	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: E. VEGAS	DRAWING ORG.: [illegible]		TITLE: TURBINES AND GENERATORS HYDRAULIC POWER CONTROL UNIT–PIPING ISOMETRIC
CHECKED: F. CUYA R.		GyM S.A.	SCL: N/S — DATE: AUG.'98 — CODE: ET–09 Sh3/3 — REV. No: 1
APPROVED: A. OLAVIDE P.			GyM S.A.



STAGE 2 AND 3
GROUPS 1,2,3 AND 4
TO DISCHARGE TUNNEL
GENERATOR N°4
GENERATOR AIR COOLER
GENERATOR N°6
GENERATOR AIR COOLER
BEARING OIL COOLER
BEARING OIL COOLER
HEAT EXCHANGER "B"
PLATE HEAT EXCHANGER
(SEE NOTE 4)
HEAT EXCHANGER "C"
SHELL AND TUBE
GENERATOR N°3
GENERATOR N°5
DUPLEX STRAINERS
CHEMICAL FEEDER PUMP
SOLENOID VALVE
FILTER
TANK
FILTER TANK
AUXILIARY PUMPS
SEE NOTE 3
SEE NOTE 2
6" WT-006-C01
6" WT-005-C01
12"
AS BUILT DRAWING
LEGEND
GATE VALVE
CHECK VALVE
GLOBE VALVE
FILTER
SOLENOID VALVE
ROTAMETER
FLOW METER
PRESSURE GAUGE
THERMOMETER
PUMP
DUPLEX STRAINER
HAND SWITCH
NOTES:
1.- SEE THE TECHNICAL SUBMITTAL EGM-01 TO IDENTIFY WHICH EQUIPMENT IS NEW OR REUSED
2.- THE EXISTING HEADERS FOR GROUPS 1,2,3 AND 4 ARE 6"φ
3.- THE NEW PIPING FOR GROUPS 1,2,3,4,5 AND 6 ARE 5"φ
4.- P&D DIAGRAM FOR HEAT EXCHANGER "B" IS VALID FOR HEAT EXCHANGER "A"

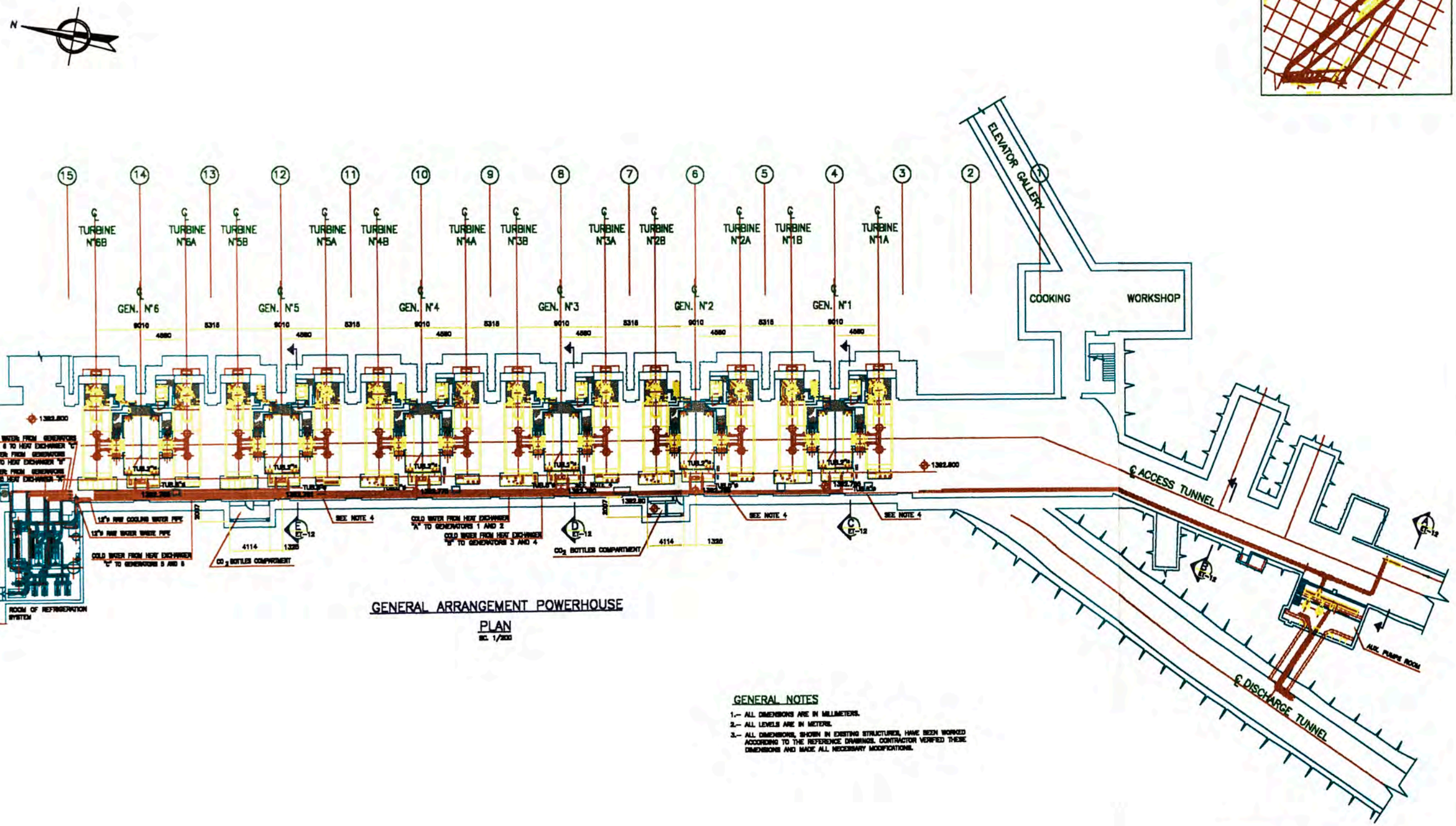
REFERENCE DRAWING

EM-05 Sh1/2 GENERATOR COOLING WATER SYSTEM – HEAT EXCHANGERS – GENERAL ARRANGEMENT – PLAN

EM-07 TRANSFORMER COOLING WATER SYSTEM – HEAT EXCHANGERS – GENERAL ARRANGEMENT – PLAN

PROJECT CODE: 1269	FILE: ET000010	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: F. CUYA R.	DRAWING CAD:		TITLE: GENERATOR COOLING WATER SYSTEM P & I DIAGRAM
CHECKED: J. FERNANDEZ			SCALE: N/S — CODE: ET-10 — REV. No 1
APPROVED: A. OLANDE F.			DATE: AUG.'98

GyM S.A.



GENERAL ARRANGEMENT POWERHOUSE PLAN

SC. 1/200

GENERAL NOTES

1.– ALL DIMENSIONS ARE IN MILLIMETERS.
2.– ALL LEVELS ARE IN METERS.
3.– ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.

AS BUILT DRAWING

REFERENCE DRAWING

EM–01 POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – PLAN
ET–12 GENERATOR COOLING WATER SYSTEM – GENERAL ARRANGEMENT – PIPING – SECTIONS

PROJECT CODE: 1288	FILE: ET0000011
DESIGNED: E. VEGAS	DRAWING ORG.:
CHECKED: F. CUYA R.	
APPROVED: A. OLAVIDE P.	

ABB POWER GENERATION INC.

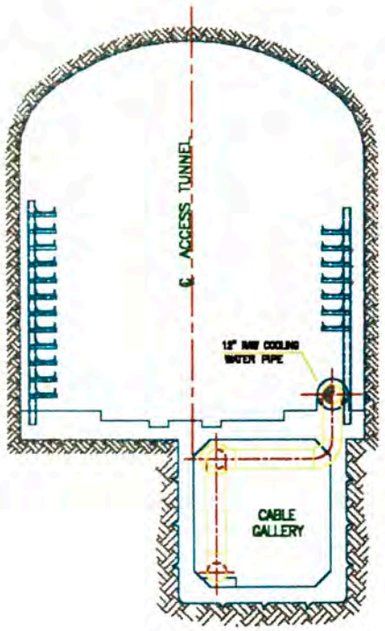
GyM S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

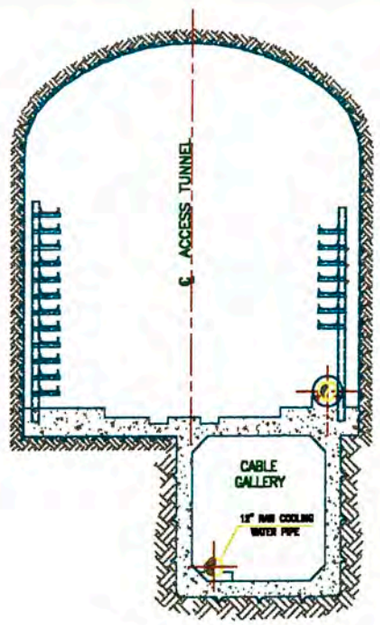
TITLE: GENERATOR COOLING WATER SYSTEM GENERAL ARRANGEMENT–PIPING PLAN

SC.: 1/200	CODE: ET–11	REV. No: 1
DATE: AUG.'98		

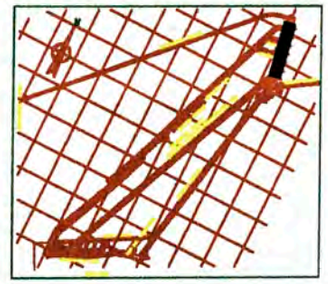
GyM S.A.

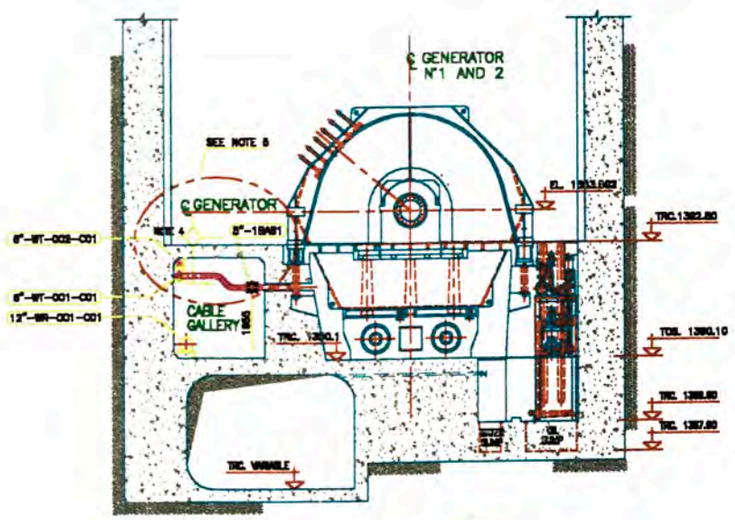


SECTION A
SC. 1/75 ET-11

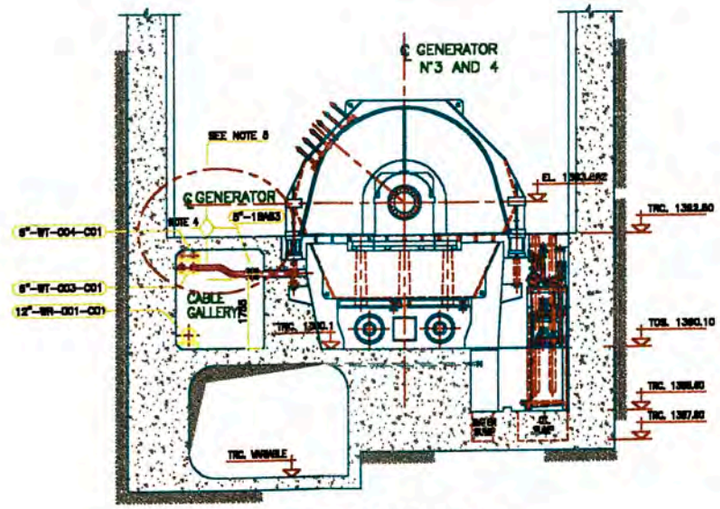


SECTION B
SC. 1/75 ET-11

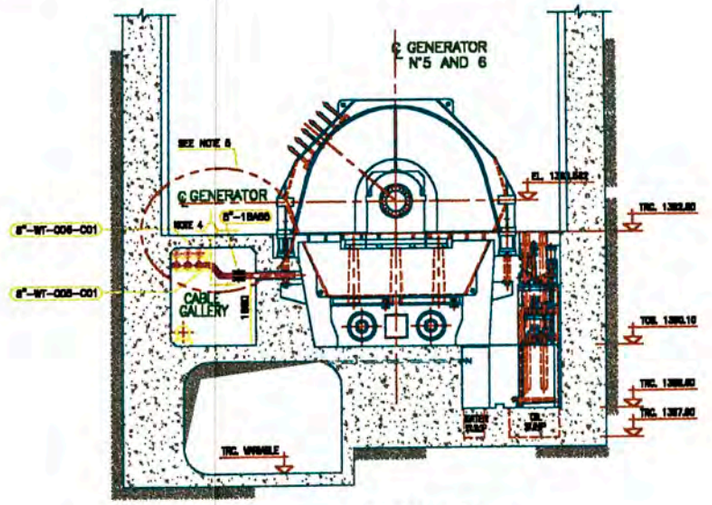




SECTION C
SC. 1/75 ET-11



SECTION D
SC. 1/75 ET-11



SECTION E
SC. 1/75 ET-11

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- THE MATERIAL TO THE RIGHT OF THE INDICATED POINT IS NEW AND SUPPLIED BY ABB.

AS BUILT DRAWING

REFERENCE DRAWING

ET-11 GENERATOR COOLING WATER SYSTEM - GENERAL ARRANGEMENT - PIPING - PLAN

PROJECT CODE: 1388	FILE: ET000012
DESIGNED: E. VEGAS	DRAWING CHK.:
CHECKED: F. GUYA R.	
APPROVED: A. CLAVIJO P.	

ABB POWER GENERATION INC.

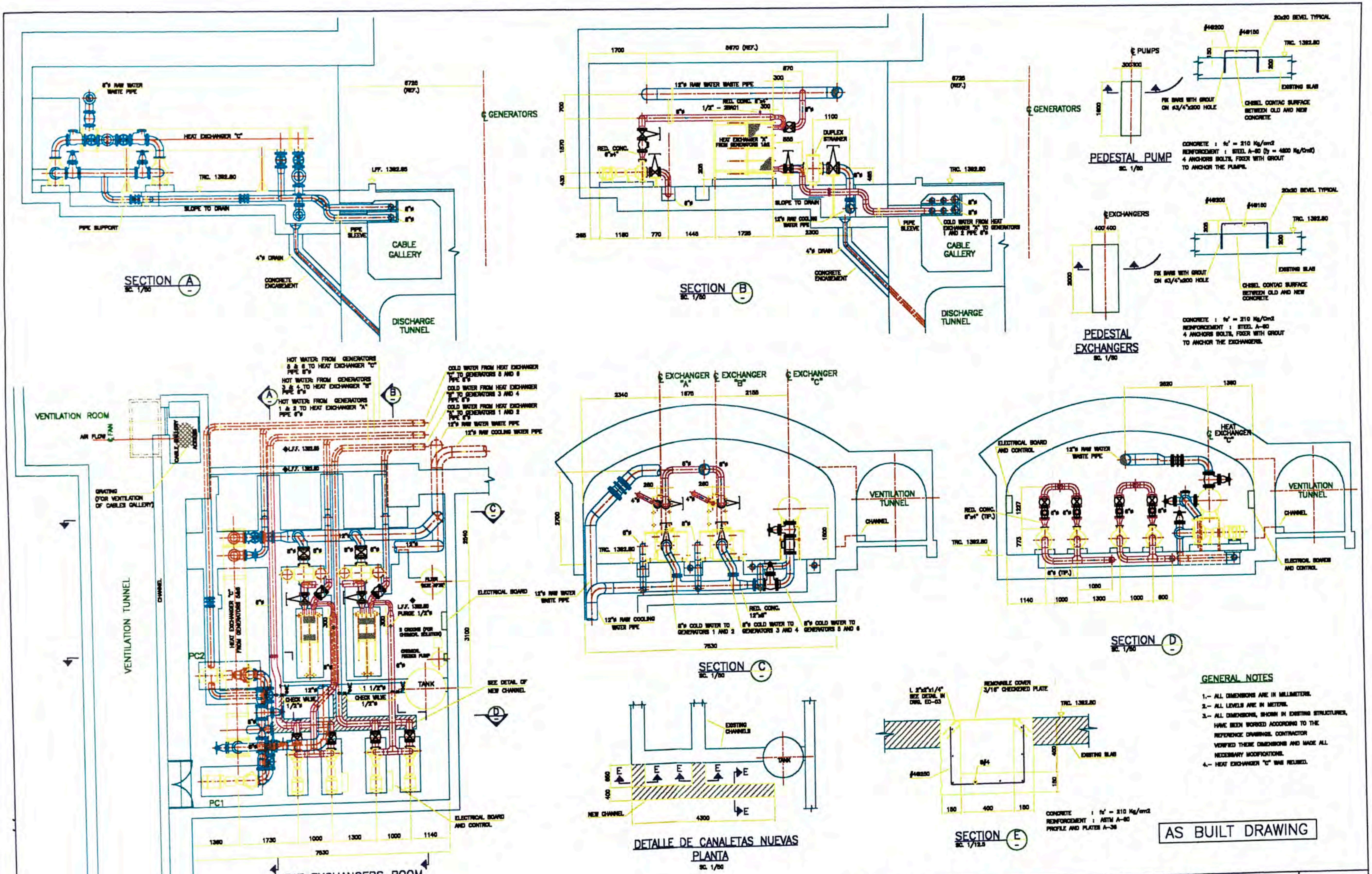
GEE S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW

TITLE: GENERATOR COOLING WATER SYSTEM GENERAL ARRANGEMENT - PIPING SECTIONS

GyM S.A.

SCA. 1/75	CODE: ET-12	REV. No 1
DATE: AUG.'98		



GENERAL NOTES

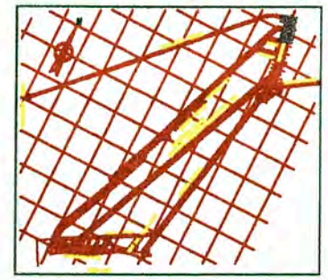
1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- HEAT EXCHANGER "C" WAS REUSED.

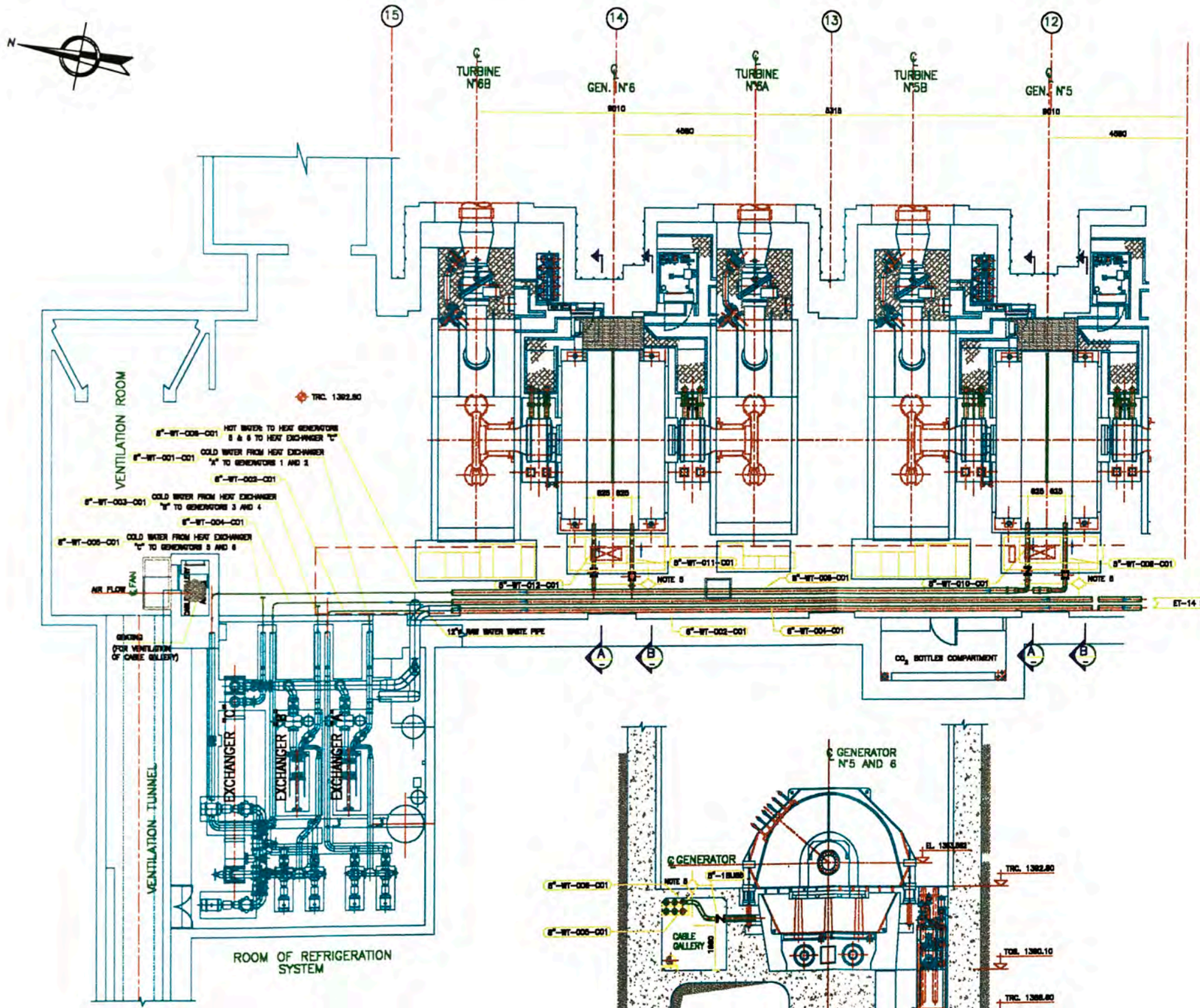
AS BUILT DRAWING

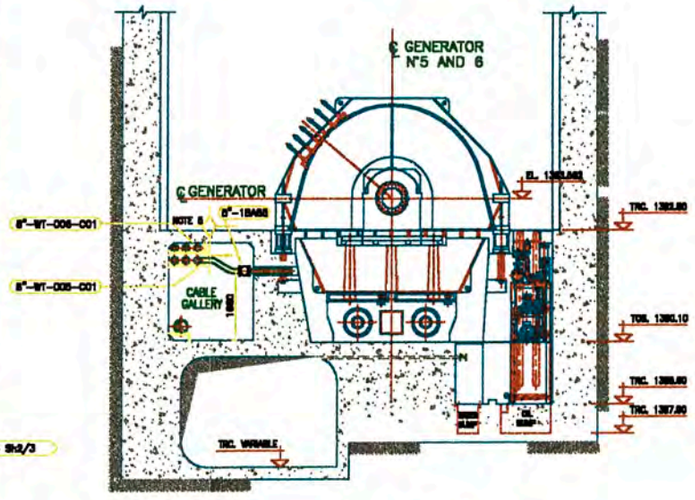
REFERENCE DRAWING

EM-01 POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – PLAN

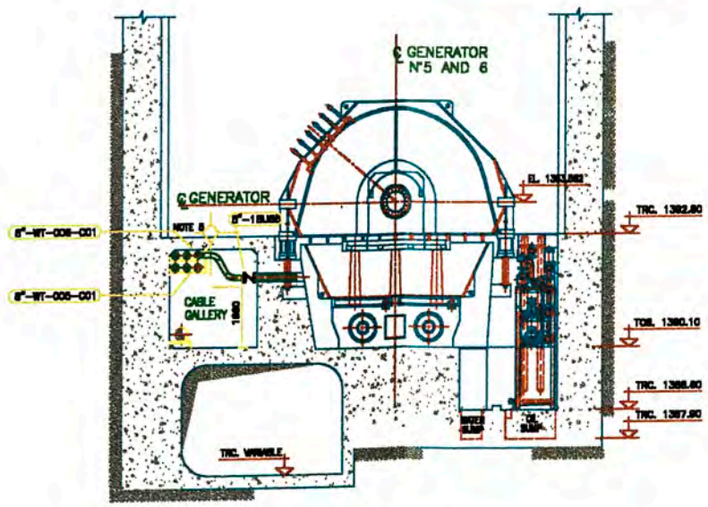
PROJECT CODE: 1288	FILE: ET000013	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: F CUYA R.	DRAWING CAD: HIDALGO/T.MEDINA		TITLE: GENERATOR COOLING WATER SYSTEM HEAT EXCHANGERS–PIPING PLAN AND SECTIONS
CHECKED: F. CUYA R.			SC.: IND. DATE: AUG.-98 CODE: ET–13 REV. No 1
APPROVED: A. OLAVIDE P.		GyM S.A.	







SECTION B
SC. 1/75



SECTION A
SC. 1/75

GENERAL NOTES

1.– ALL DIMENSIONS ARE IN MILLIMETERS.

2.– ALL LEVELS ARE IN METERS.

3.– ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.

4.– SEE DRAWING ET–16 AND ET–18 WHERE IT'S SHOWN THE INTERNAL FEEDING PIPING TO THE AIR COOLER AND LUBE OIL.

5.– THE MATERIAL BEYOND THE INDICATED POINT IS NEW AND SUPPLIED BY ABB.

6.– THE EXISTING INLET/OUTLET PIPING LINE OF THE COOLING WATER SYSTEM IS 4"ø FOR GENERATORS 1, 2, 3 AND 4 FOR GENERATORS 5 AND 6 BUT ACCORDING TO THE COOLING/VENTILATION SYSTEM REPORT THIS LINE IS OF 8"ø.

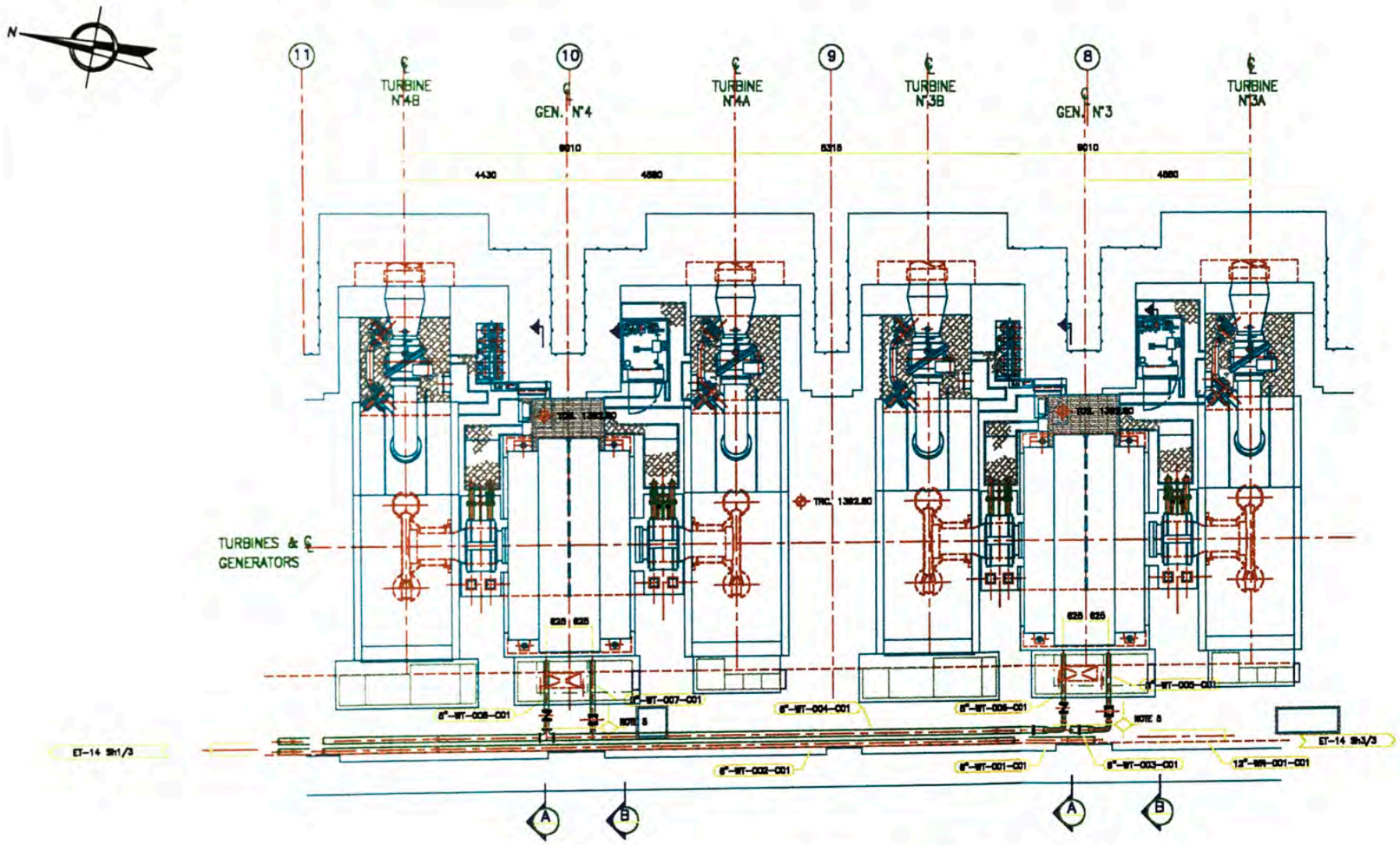
AS BUILT DRAWING

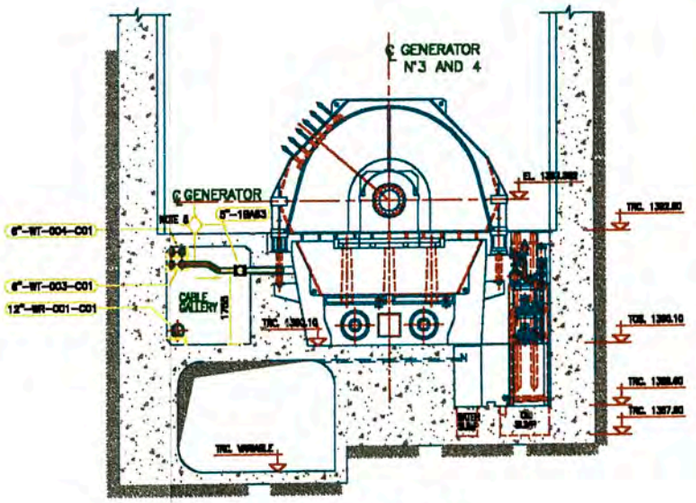
REFERENCE DRAWING

EM–01	POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – PLAN
ET–14 Sh2/3	GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY–PIPING–PLAN & SECTIONS
ET–14 Sh3/3	GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY–PIPING–PLAN & SECTIONS

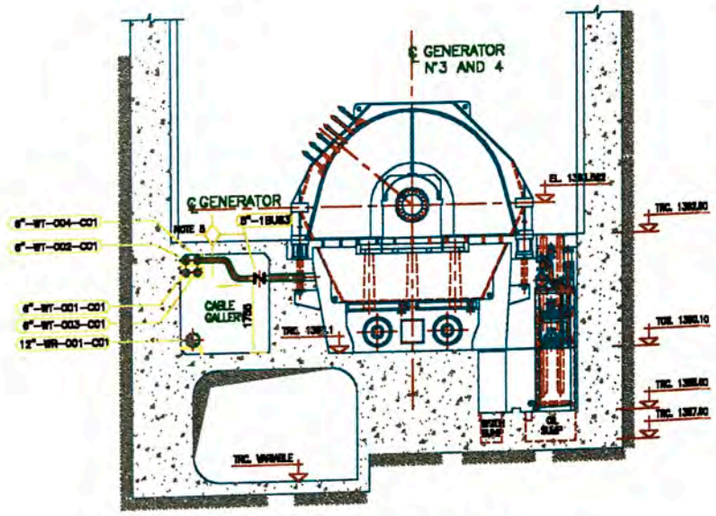
PROJECT CODE: 1288	FILE: ET000014	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: E. VEGAS	DRAWING CHCK: H.HIDALGO/T.VIERA		TITLE: GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY–PIPING–PLAN & SECTIONS
CHECKED: F. CUYA			SCL: 1/75
APPROVED: A. OLAVIDE			DATE: AUG.'98
			CODE: ET–14 Sh1/3
			REV. No: 1

GyM S.A.





SECTION B
SC. 1/75



SECTION A
SC. 1/75

GENERAL NOTES

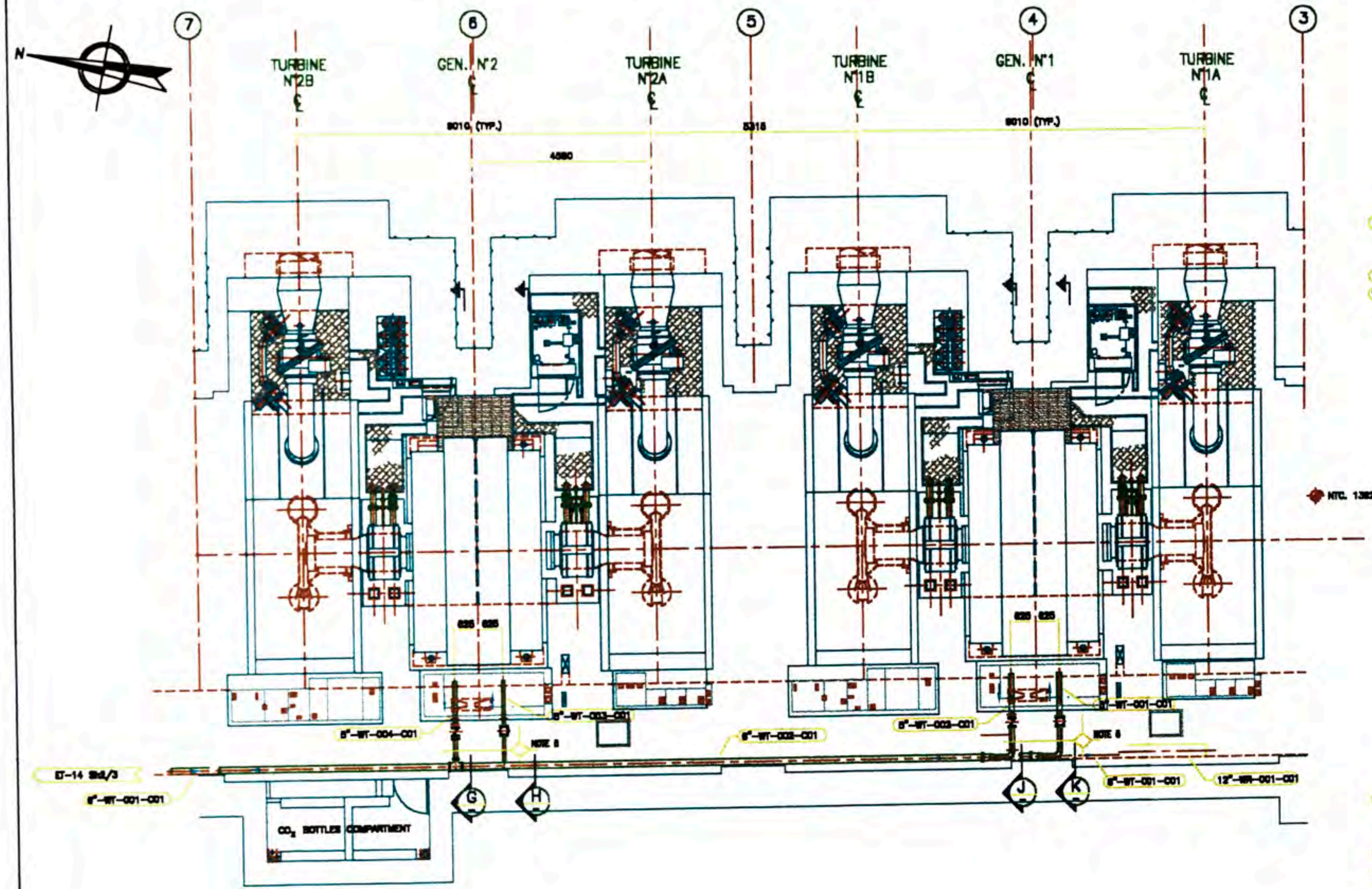
1.– ALL DIMENSIONS ARE IN MILLIMETERS.
2.– ALL LEVELS ARE IN METERS.
3.– ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.– SEE DRAWING ET–16 AND ET–18 WHERE IT'S SHOWN THE INTERNAL FEEDING PIPING TO THE AIR COOLER AND LUBE OIL.
5.– THE MATERIAL BEYOND THE INDICATED POINT IS NEW AND SUPPLIED BY ABB.

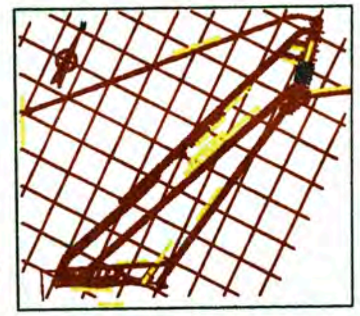
AS BUILT DRAWING

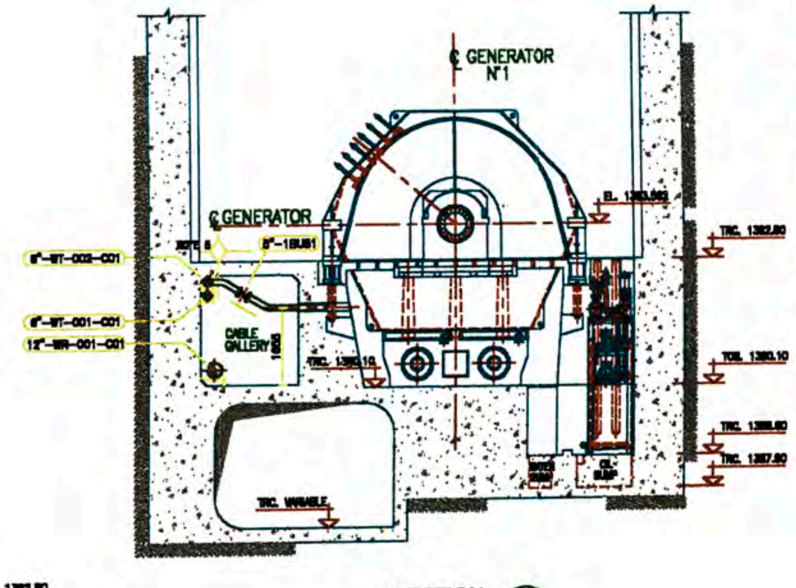
REFERENCE DRAWING

ET–14 Sh1/3	GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY–PIPING–PLAN & SECTIONS
ET–14 Sh3/3	GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY–PIPING–PLAN & SECTIONS

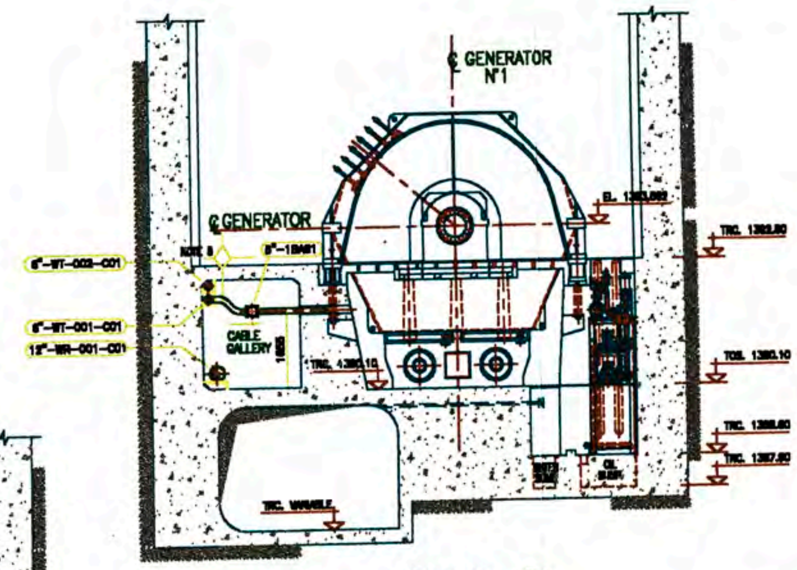
PROJECT CODE: 1288	FILE: ET10004A	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNED: E. VEGAS	DRAWING CKD.: L.HIDALGO/T.VEGA		TITLE: GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY–PIPING–PLAN & SECTIONS
CHECKED: F. CUYA R.			GyM S.A.
APPROVED: A. OLAVIDE P.			SCL: 1/75 DATE: AUG.'99 CODE: ET–14 Sh2/3 REV. No: 1



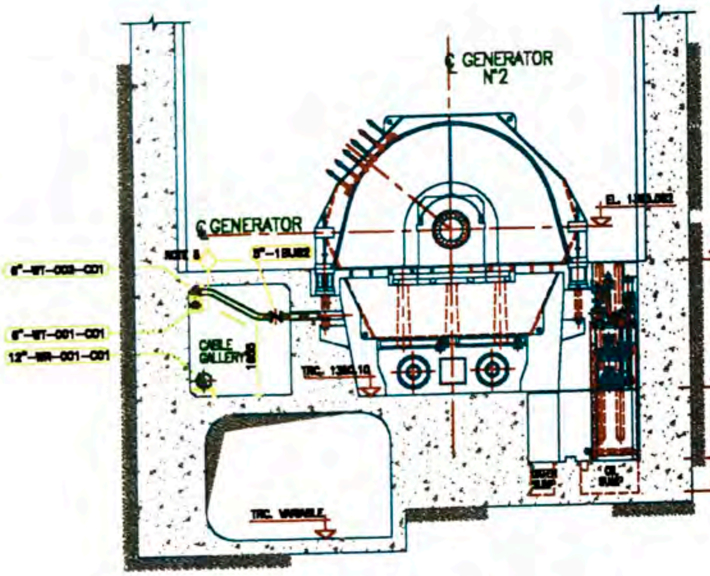




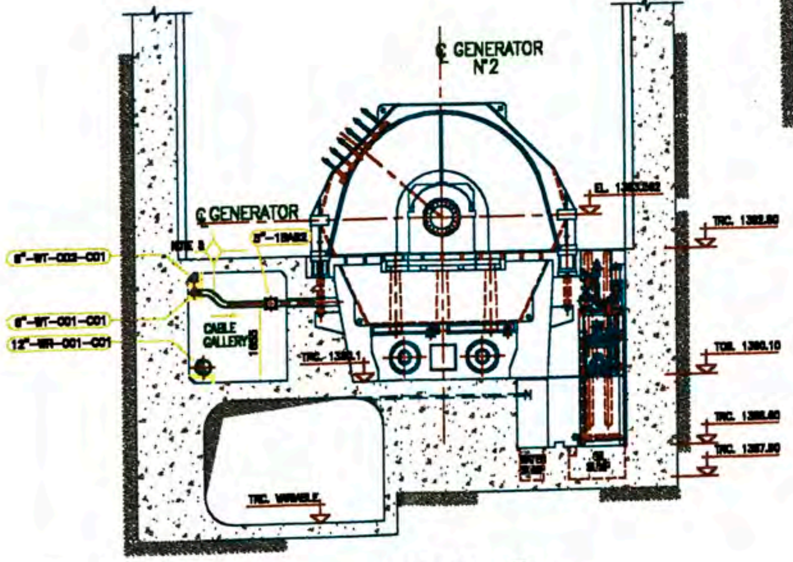
SECTION J
SC. 1/75



SECTION K
SC. 1/75



SECTION G
SC. 1/75



SECTION H
SC. 1/75

GENERAL NOTES

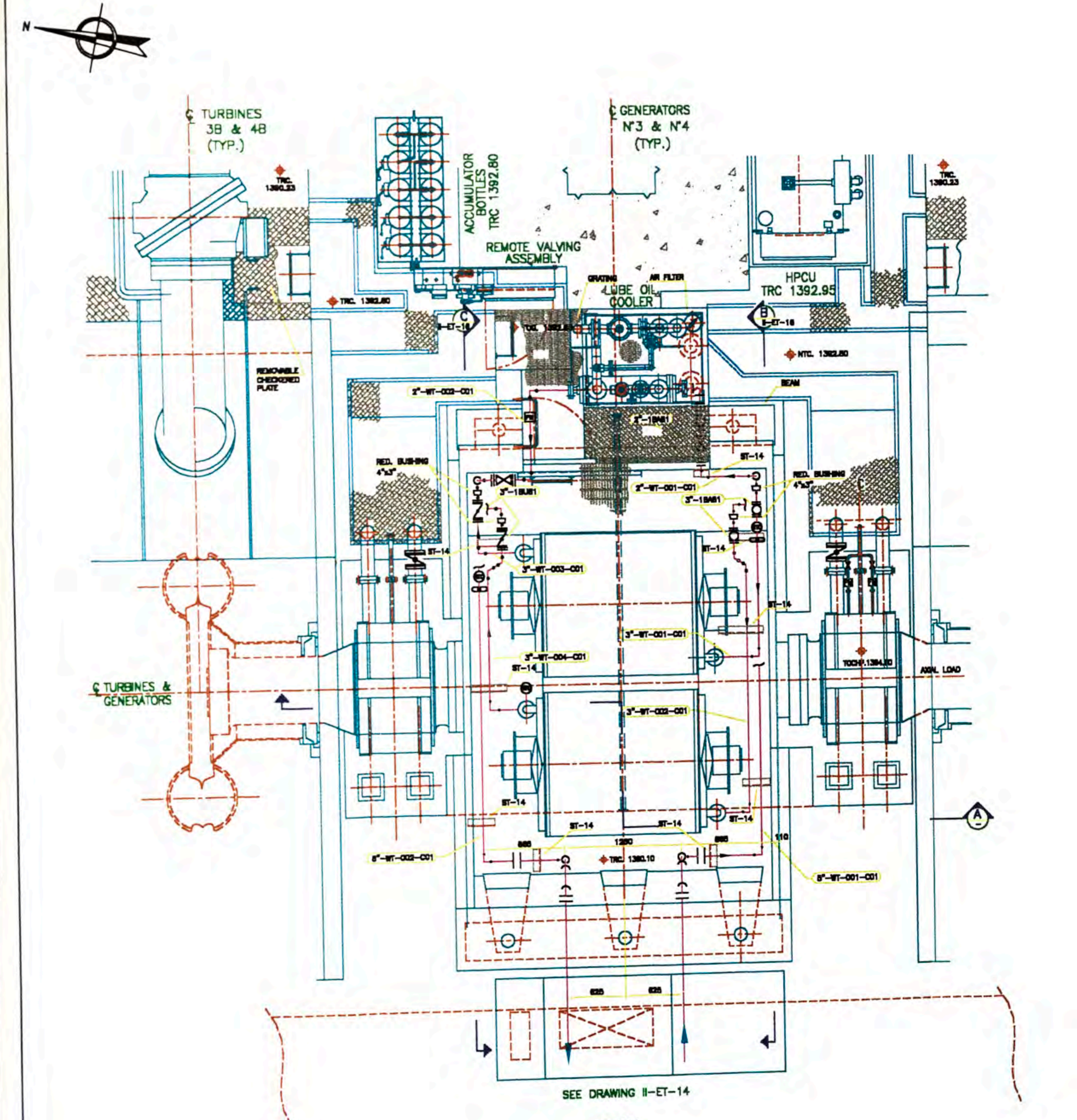
1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- SEE DRAWING ET-16 AND ET-15 WHERE IT'S SHOWN THE INTERNAL FEEDING PIPING TO THE AIR COOLER AND LUBE OIL.
5.- THE MATERIAL BEYOND THE INDICATED POINT IS NEW AND SUPPLIED BY ABB.

AS BUILT DRAWING

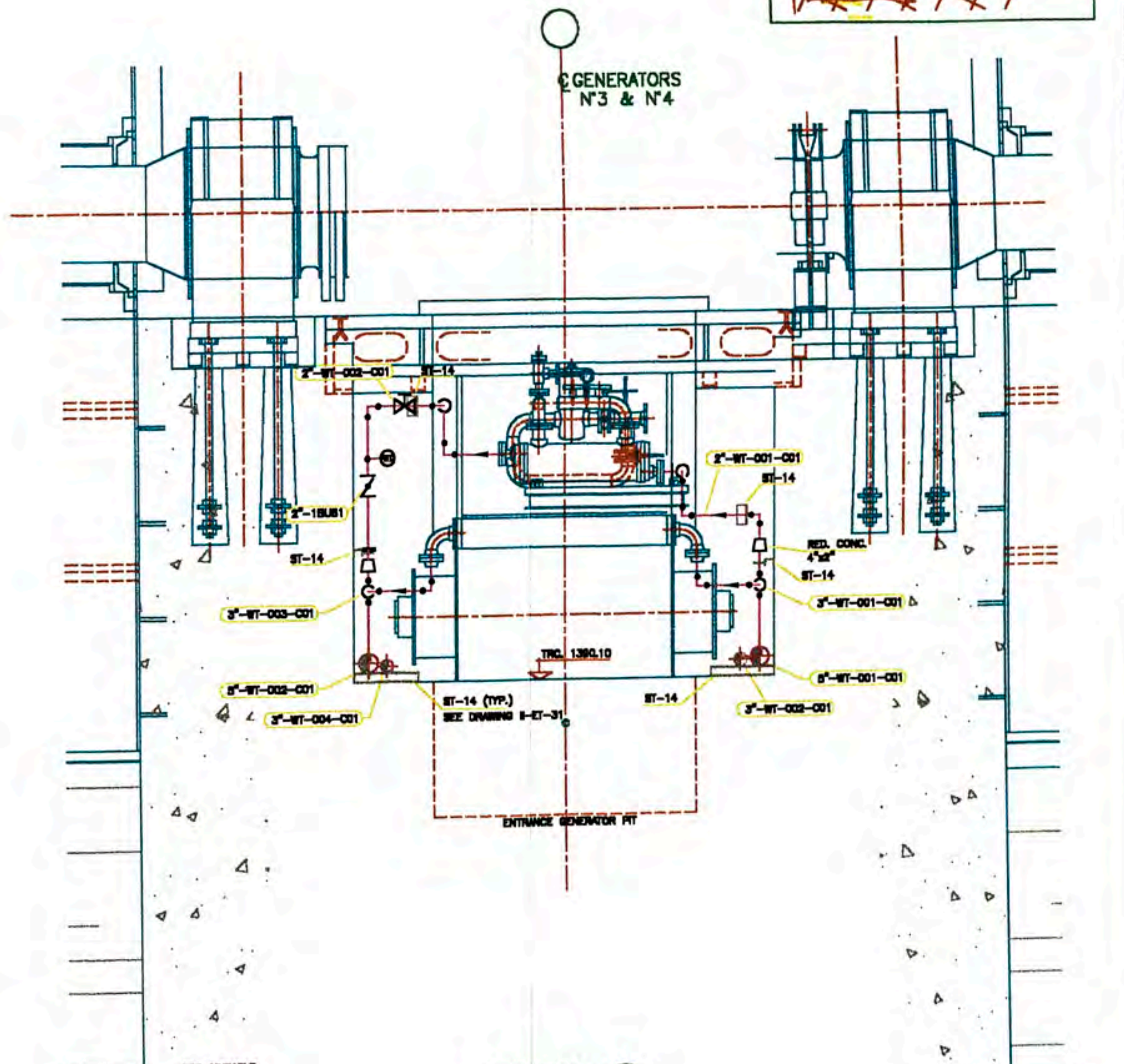
REFERENCE DRAWING

ET-14 Sh1/3 GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY-PIPING-PLAN & SECTIONS
ET-14 Sh2/3 GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY-PIPING-PLAN & SECTIONS

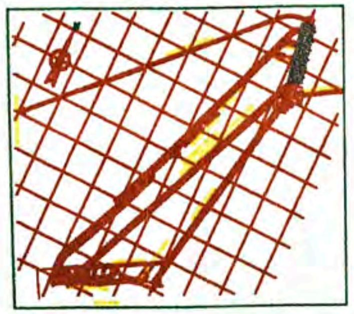
PROJECT CODE: 1288	FILE: ET000148	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW	GyM
DESIGNED: E. VEGAS	DRAWING CHECK: [illegible]		TITLE: GENERATOR COOLING WATER SYSTEM HOT AND COLD WATER AT THE CABLE GALLERY-PIPING-PLAN & SECTIONS	GyM S.A.
CHECKED: F. CUYA R.		GEK S.A.	SCALE: 1/75 — CODE: ET-14 Sh3/3 — REV. No 1	
APPROVED: A. OLAVIDE P.			DATE: AUG.'98	



PLAN
SC. 1/25



SECTION A
SC. 1/25



GENERAL NOTES

1.– THIS DRAWING IS TYPICAL FOR GROUPS 1, 2, 3, 4, 5 AND 6.
2.– ALL PIPING, VALVES AND FITTINGS IS ACCORDING TO THE SPECIFICATION ESM–01 AND SUPPLIED BY ABB.
3.– ACCORDING TO ABB INFORMATION FOR MAINTENANCE PURPOSE THE COOLING FANS HAVE BEEN REMOVED TOWARD INSIDE IN THE DIRECTION TO ACCESS PIT.
4.– FOR SUPPORTS SEE DRAWING ET–31 Sh1/2 & 2/2.

AS BUILT DRAWING

REFERENCE DRAWING

EM–01	POWERHOUSE – EQUIPMENT GENERAL ARRANGEMENT – PLAN
ET–16	GENERATOR COOLING WATER SYSTEM AIR COOLER AND LUBE OIL BEARING SYSTEM PIPING – SECTIONS
ET–31 Sh1/2 & 2/2	STANDARDS OF SUPPORTS

PROJECT CODE: 1289	FILE: ET000015
DESIGNED: F. CUYA R.	DRAWING CAD.: R.HIDALGO/T.VERA
CHECKED: J. FERNANDEZ	
APPROVED: A. OLAVIDE P.	

ABB
POWER GENERATION INC.

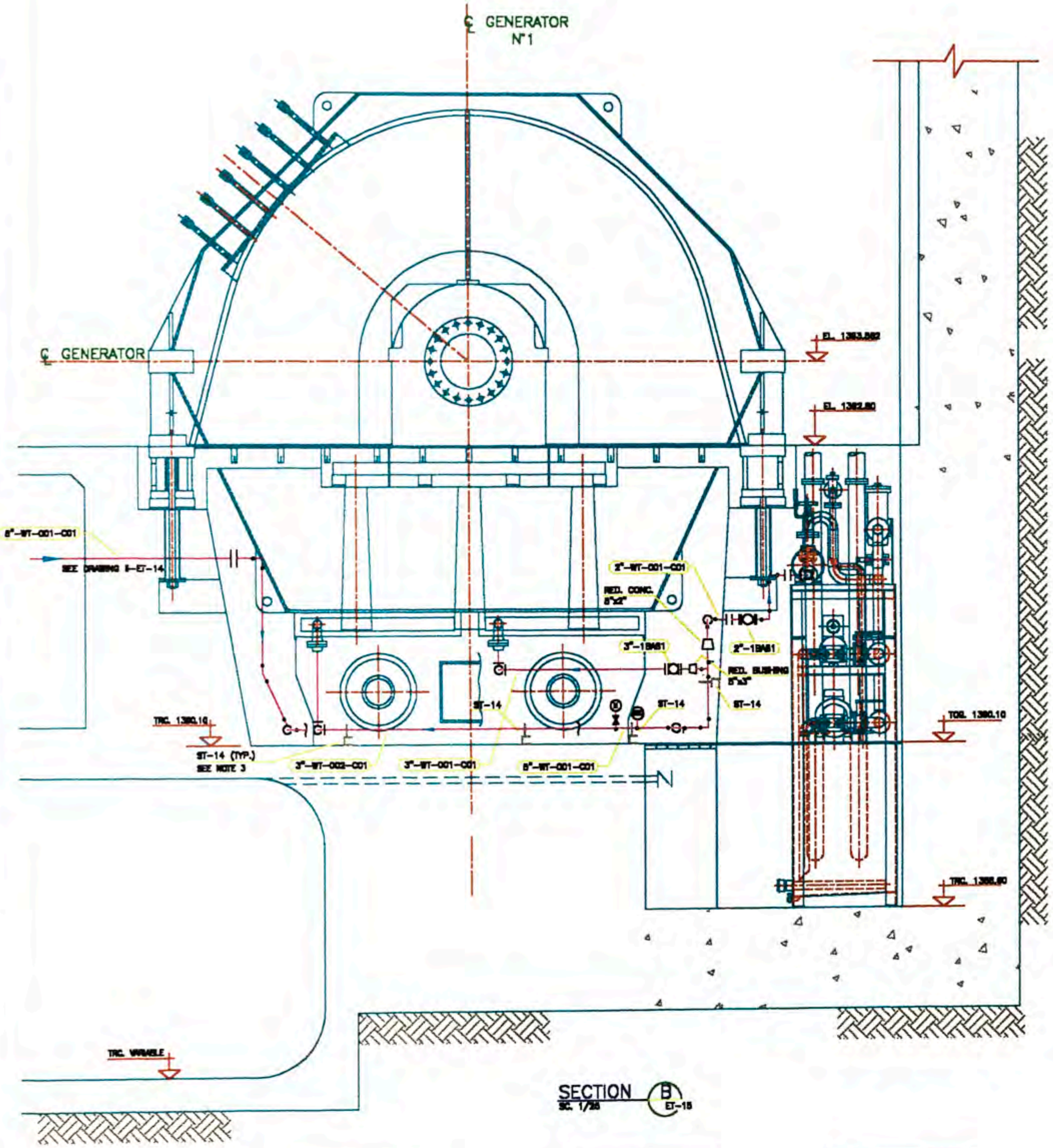
GyM S.A.

PROJECT: **EGENOR S.A.**
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

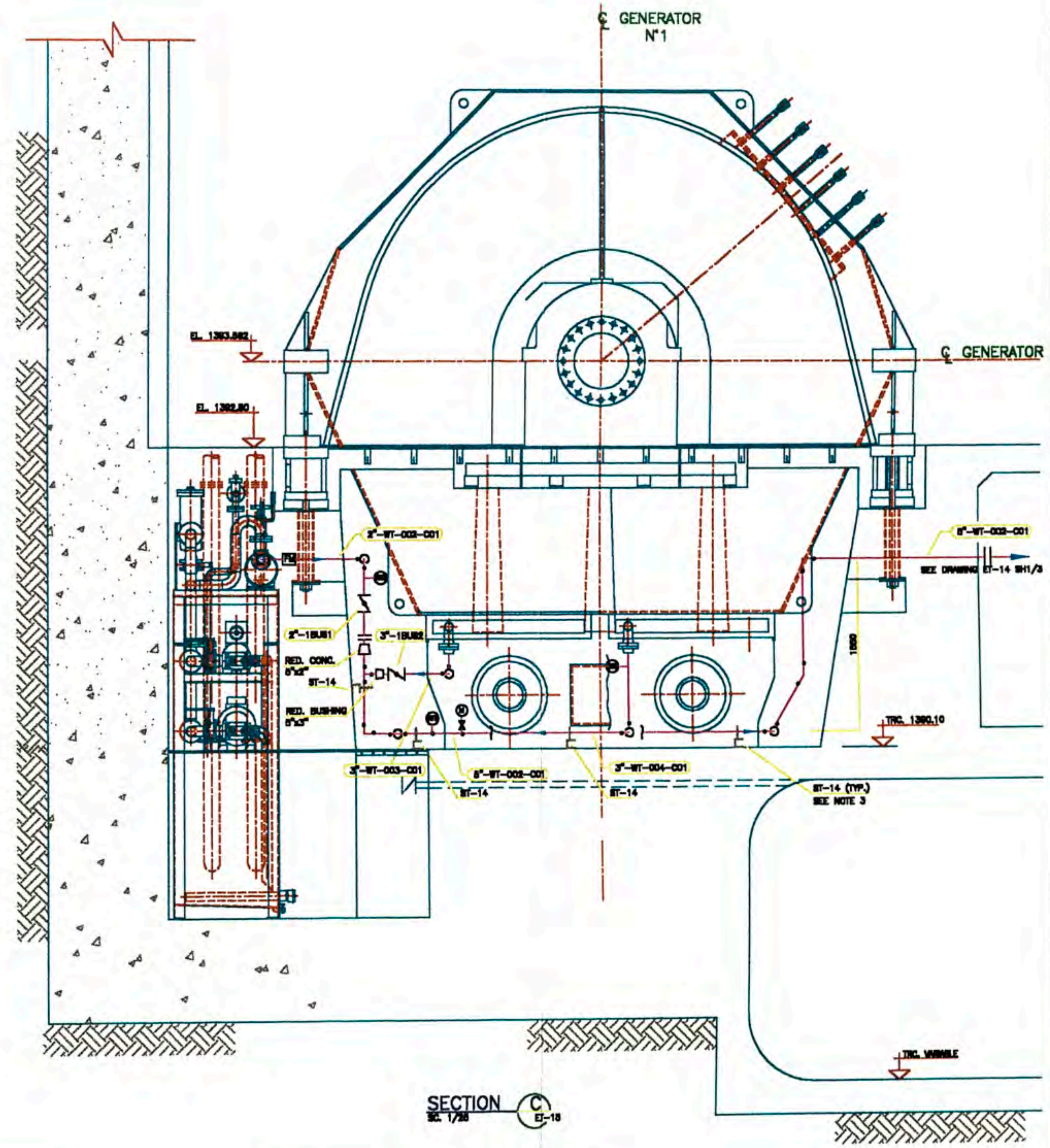
TITLE: GENERATOR COOLING WATER SYSTEM AIR COOLER AND LUBE OIL BEARING SYSTEM PIPING – PLAN

SC.: 1/25	CODE: ET–15	REV. No: 1
DATE: AUG.'98		

GyM
GyM S.A.



SECTION B
SC. 1/25 ET-15



SECTION C
SC. 1/25 ET-15

GENERATOR N°2	
DIAM.	COD.
5"	5"-WT-003-C01 5"-WT-004-C01
3"	3"-WT-005-C01 3"-WT-006-C01 3"-WT-007-C01 3"-WT-008-C01
2"	2"-WT-003-C01 2"-WT-004-C01

GENERATOR N°3	
DIAM.	COD.
5"	5"-WT-005-C01 5"-WT-006-C01
3"	3"-WT-009-C01 3"-WT-010-C01 3"-WT-011-C01 3"-WT-012-C01
2"	2"-WT-005-C01 2"-WT-006-C01

GENERATOR N°4	
DIAM.	COD.
5"	5"-WT-007-C01 5"-WT-008-C01
3"	3"-WT-013-C01 3"-WT-014-C01 3"-WT-015-C01 3"-WT-016-C01
2"	2"-WT-007-C01 2"-WT-008-C01

GENERATOR N°5	
DIAM.	COD.
5"	5"-WT-009-C01 5"-WT-010-C01
3"	3"-WT-017-C01 3"-WT-018-C01 3"-WT-019-C01 3"-WT-020-C01
2"	2"-WT-009-C01 2"-WT-010-C01

GENERATOR N°6	
DIAM.	COD.
5"	5"-WT-011-C01 5"-WT-012-C01
3"	3"-WT-021-C01 3"-WT-022-C01 3"-WT-023-C01 3"-WT-024-C01
2"	2"-WT-011-C01 2"-WT-012-C01

GENERAL NOTES

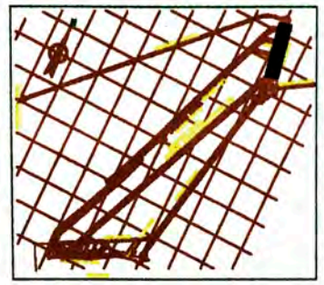
1.- THIS DRAWING IS TYPICAL FOR GROUPS 1, 2, 3, 4, 5 AND 6.
2.- ALL PIPING, VALVES AND FITTINGS IS ACCORDING TO THE SPECIFICATION ESM-01 AND SUPPLIED BY ABB
3.- FOR SUPPORTS SEE DRAWING ET-31 Sh1/2 & 2/2.
4.- ACCORDING TO ABB, NO COOLING FANS ARE NEEDED.

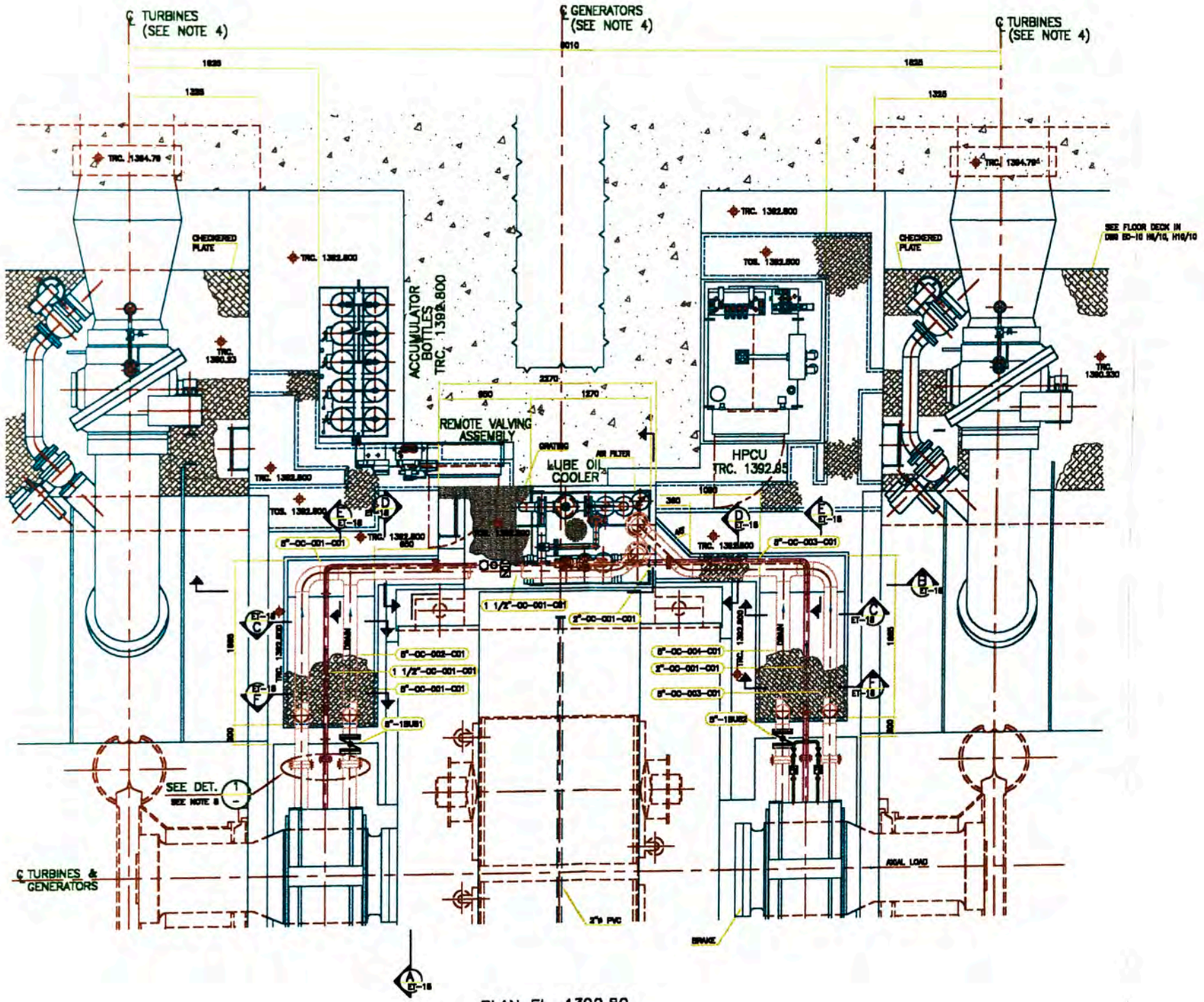
AS BUILT DRAWING

REFERENCE DRAWING

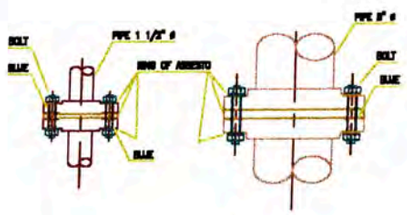
ET-14 Sh1, 2 & 3	GENERATOR COOLING WATER SYSTEM – HOT AND COLD WATER AT THE CABLE GALLERY PIPING – PLAN AND SECTIONS
ET-15	GENERATOR COOLING WATER SYSTEM – AIR COOLER AND LUBE OIL BEARING SYSTEM PIPING – PLAN
ET-31 Sh1/2 & 2/2	STANDARS OF SUPPORT

PROJECT CODE: 1280	FILE: ET000012	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW
DESIGNER: J. FERNANDEZ	DRAWING CAD.:		TITLE: GENERATOR COOLING WATER SYSTEM AIR COOLER AND LUBE OIL BEARING SYSTEM PIPING – SECTIONS
CHECKED: F. CUYA		GyM S.A.	SC.: 1/25 DATE: AUG.'98 CODE: ET-16 REV. No 1
APPROVED: A. OLAVIDE			GyM S.A.





PLAN EL. 1392.80
SC. 1/25



DETAIL 1
SC. 1/5

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS
2.- ALL LEVELS ARE IN METERS
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- THIS ARRANGEMENT IS VALID FOR ALL GROUPS TURBINE-GENERATOR, ONLY THE PIPING CODE IS VARIABLE SUCH AS SHOWN ON DRAWING ET-18.
5.- THE JACKING OIL BEARING SYSTEM AND PIPING ARE INCLUDED ON BEARING SUPPORT SEE DRAWING ABB 41D80088.
6.- ABOUT THE OIL PIPING, THERE IS ONLY A VALVE FOR THE DRAIN PIPE. THERE IS NOT A VALVE IN THE OUTLET PIPE. SEE DRAWING ABB 41D78070.
7.- FOR SUPPORTS SEE DRAWING ET-31 Sh1/2 & 2/2.
8.- ONLY IN TURBINES 6B, 5B, 4B, 3B, 2B AND 1B.

AS BUILT DRAWING

REFERENCE DRAWING

EM-01	POWERHOUSE EQUIPMENT GENERAL ARRANGEMENT – PLAN
ET-18	GENERATOR COOLING WATER SYSTEM – LUBE OIL BEARING SYSTEM – PIPING – SECTIONS
ET31 Sh1 & 2	STANDARDS OF SUPPORT

PROJECT CODE: 1288	FILE: ET000017
DESIGNED: E. VEGAS	DRAWING CHCK:
CHECKED: F. CUYA	
APPROVED: A. CLAVIJO	

ABB POWER GENERATION INC.

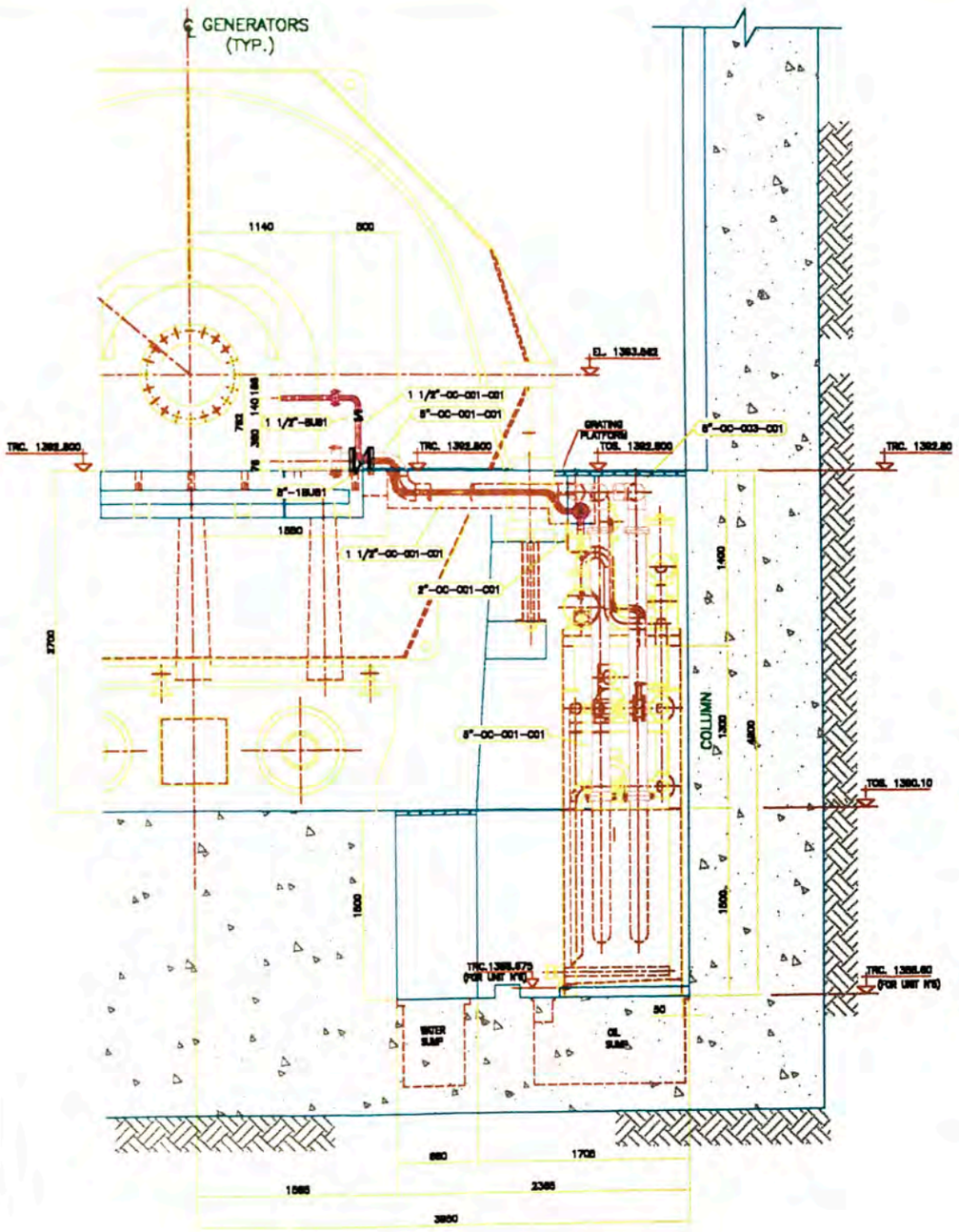
GMI S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

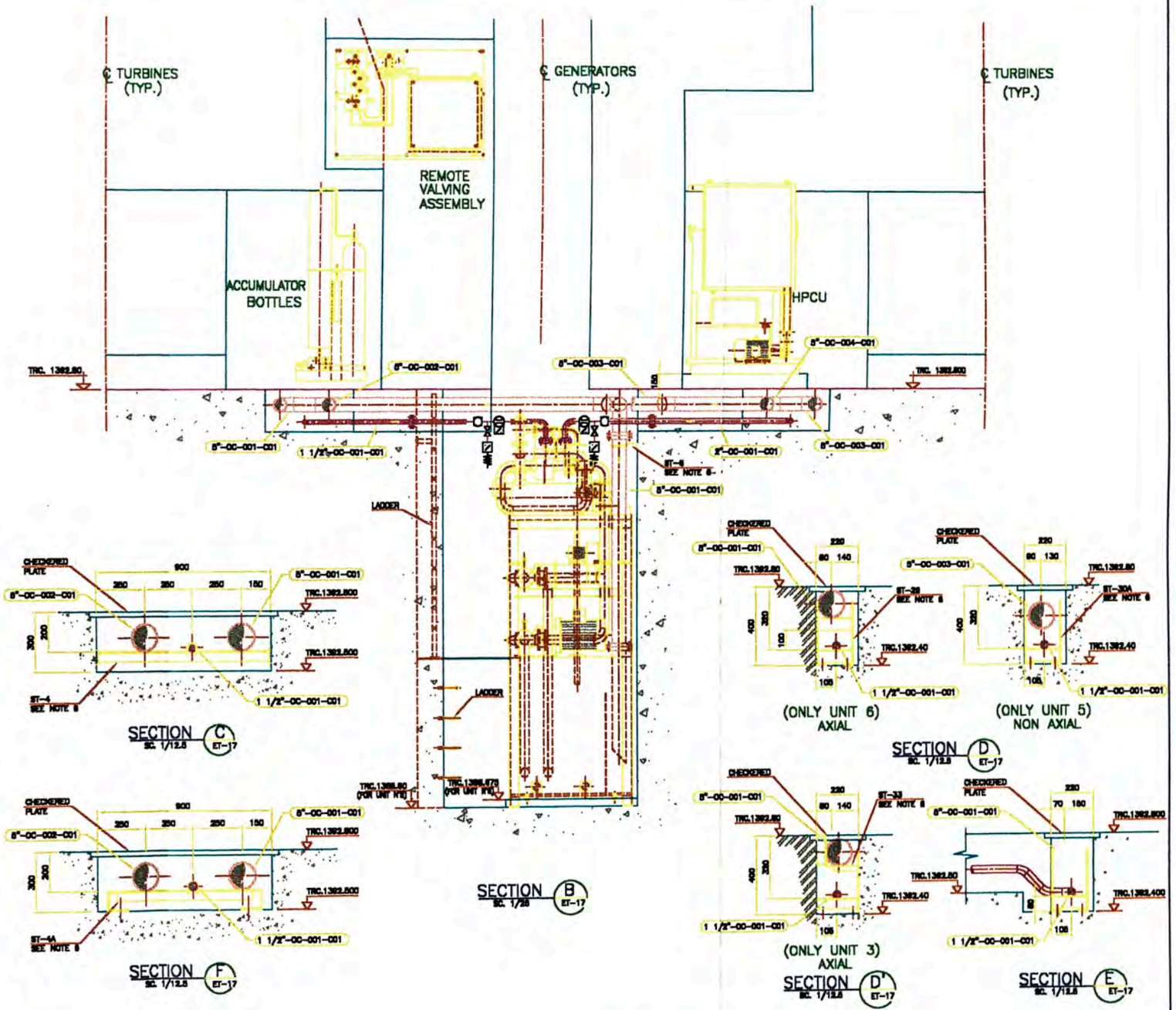
TITLE: GENERATOR COOLING WATER SYSTEM LUBE OIL BEARING SYSTEM – PIPING PLAN

SCL: 1/25	CODE: ET–17	REV. No: 1
DATE: AUG.'98		

GyM S.A.



SECTION A SC. 1/25 ET-17



SECTION C SC. 1/12.5 ET-17

SECTION B SC. 1/25 ET-17

SECTION F SC. 1/12.5 ET-17

SECTION D SC. 1/12.5 ET-17

SECTION D' SC. 1/12.5 ET-17

SECTION E SC. 1/12.5 ET-17

GENERATOR N°2	
DIAM.	COD.
8"	8"-OC-005-C01 8"-OC-006-C01 8"-OC-007-C01 8"-OC-008-C01
2"	2"-OC-002-C01
1 1/2"	1 1/2"-OC-003-C01

GENERATOR N°3	
DIAM.	COD.
8"	8"-OC-009-C01 8"-OC-010-C01 8"-OC-011-C01 8"-OC-012-C01
2"	2"-OC-003-C01
1 1/2"	1 1/2"-OC-003-C01

GENERATOR N°4	
DIAM.	COD.
8"	8"-OC-013-C01 8"-OC-014-C01 8"-OC-015-C01 8"-OC-016-C01
2"	2"-OC-004-C01
1 1/2"	1 1/2"-OC-004-C01

GENERATOR N°5	
DIAM.	COD.
8"	8"-OC-017-C01 8"-OC-018-C01 8"-OC-019-C01 8"-OC-020-C01
2"	2"-OC-005-C01
1 1/2"	1 1/2"-OC-005-C01

GENERATOR N°6	
DIAM.	COD.
8"	8"-OC-021-C01 8"-OC-022-C01 8"-OC-023-C01 8"-OC-024-C01
2"	2"-OC-006-C01
1 1/2"	1 1/2"-OC-006-C01

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS.
2.- ALL LEVELS ARE IN METERS.
3.- ALL DIMENSIONS, SHOWN IN EXISTING STRUCTURES, HAVE BEEN WORKED ACCORDING TO THE REFERENCE DRAWINGS. CONTRACTOR VERIFIED THESE DIMENSIONS AND MADE ALL NECESSARY MODIFICATIONS.
4.- THE JACKING OIL BEARING SYSTEM AND PIPING ARE INCLUDED ON BEARING SUPPORT. SEE DRAWING ABB 41D60068
5.- ABOUT THE OIL PIPING, THERE IS ONLY A VALVE FOR THE DRAIN PIPE. THERE IS NOT A VALVE IN THE OUTLET PIPE. SEE DRAWING ABB 41D70070.
6.- FOR SUPPORTS SEE DRAWINGS ET-31 Sh 1/2 & 2/2.

AS BUILT DRAWING

REFERENCE DRAWING

ET-17 GENERATOR COOLING WATER SYSTEM – LUBE OIL BEARING SYSTEM – PIPING – PLAN
ET31 Sh1 & 2 STANDARDS OF SUPPORT
EM-04 Sh3/3 TURBINES AND GENERATORS – GENERAL ARRANGEMENT GROUP TURBINE-GENERATOR – SECTIONS

PROJECT CODE: 1395	FILE: ET000018
DESIGNED: E. VEGAS	DRAWING CALC:
CHECKED: F. CUYA	
APPROVED: A. OLAVIDE	

ABB POWER GENERATION INC.

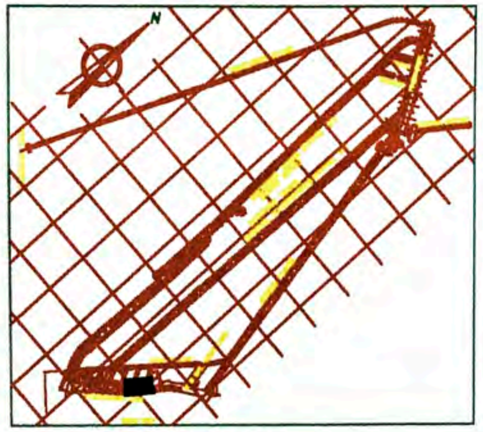
GMI S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

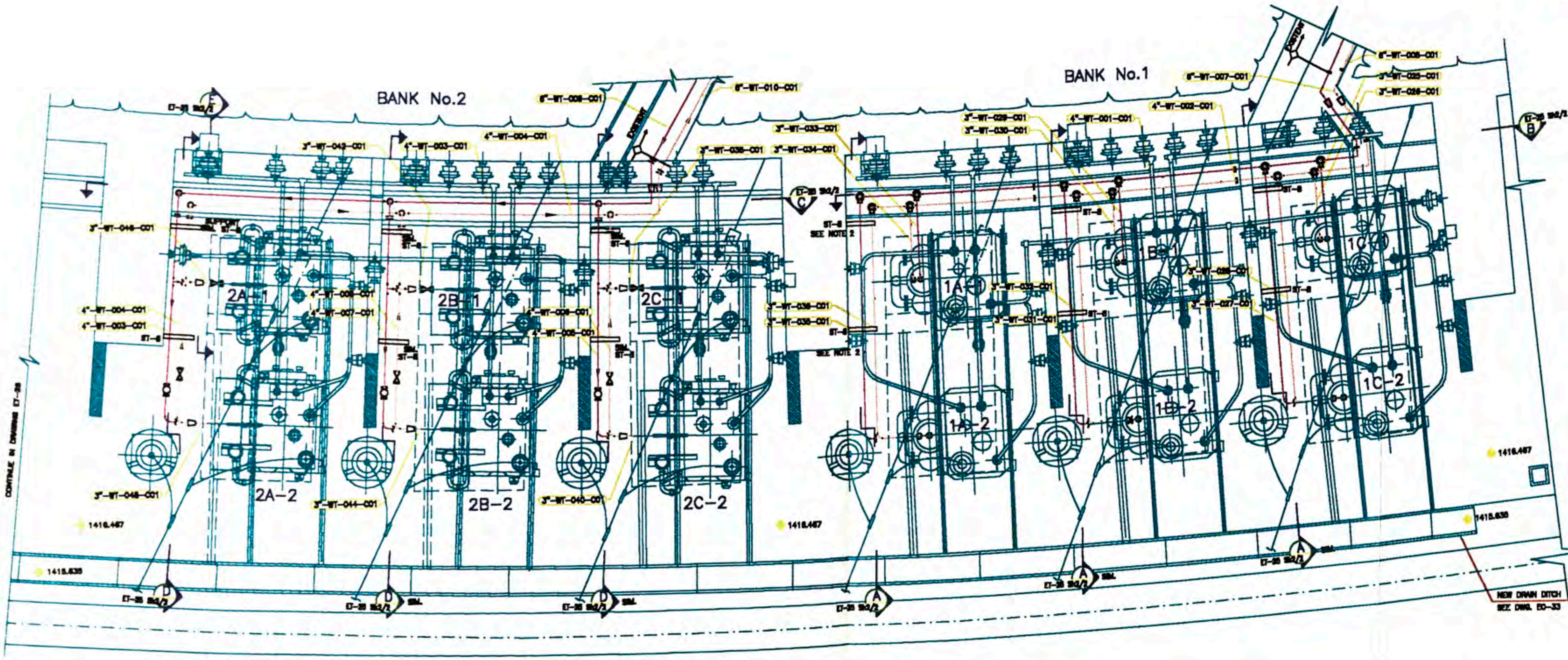
TITLE: GENERATOR COOLING WATER SYSTEM LUBE OIL BEARING SYSTEM – PIPING SECTIONS

SCALE	CODE	REV. No
1/25	ET-18	1
DATE: AUG.'98		

GyM S.A.



KEY PLAN



TRANSFORMER BANK N°1 AND N°2 – PLAN

ESC. 1/50

NOTE :

1.- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS IN METERS.

2.- FOR SUPPORTS SEE DRAWING ET-31 Sh1 & 2.

AS BUILT DRAWING

REFERENCE DRAWING

ET-25 Sh2/2	TRANSFORMER COOLING WATER SYSTEM – GENERAL ARRANGEMENT PIPING – PLAN – TRANSFORMER BANK N°1 & N°2
ET-26	TRANSFORMER COOLING WATER SYSTEM – GENERAL ARRANGEMENT PIPING – PLAN AND SECTIONS – TRANSFORMER BANK N°3
ET-31 Sh1 & 2	STANDARDS OF SUPPORT
EO-33	TRANSFORMER BANK OIL COLLECTION CHANNEL PLAN AND PROFILE
EE-057A	TRANSFORMERS BANK 1 AND 2 ARRANGEMENT GENERAL

PROJECT CODE: 1289	FILE: ET000025
DESIGNED: E. VEGAS	DRAWING CAD.: [illegible]
CHECKED: F. CUYA R.	
APPROVED: A. OLAVIDE P.	

ABB POWER GENERATION INC.

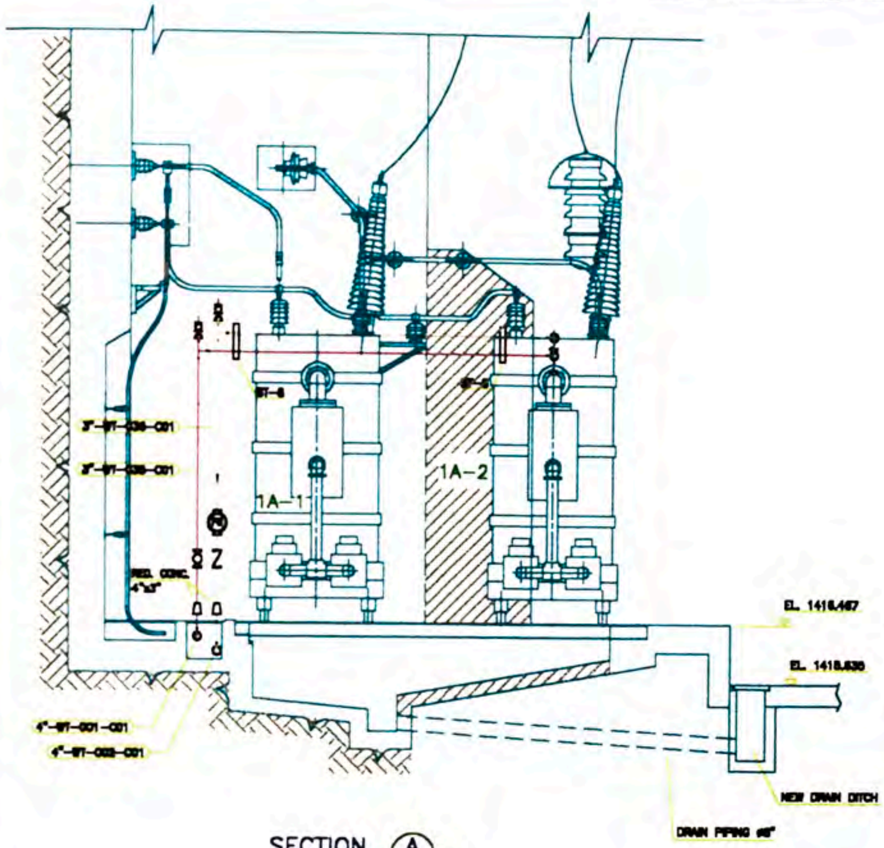
GMI S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

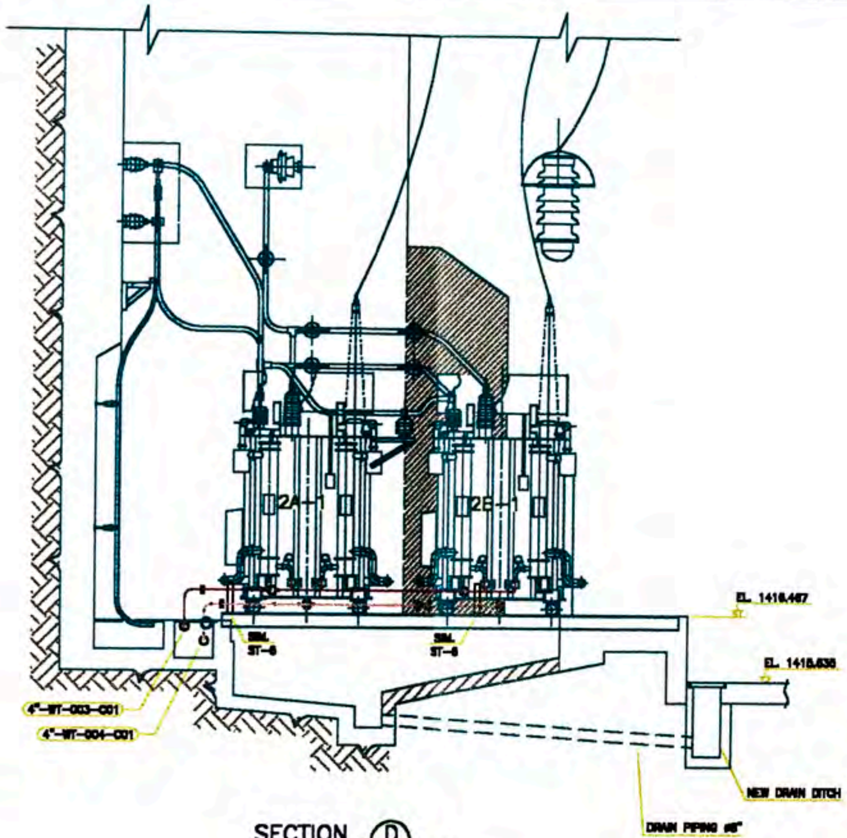
TITLE: TRANSFORMER COOLING WATER SYSTEM GENERAL ARRANGEMENT–PIPING–PLAN TRANSFORMES BANK 1 AND 2

SCL: 1/50	CODE: ET-25 Sh1/2	REV. No 1
DATE: AUG.'98		

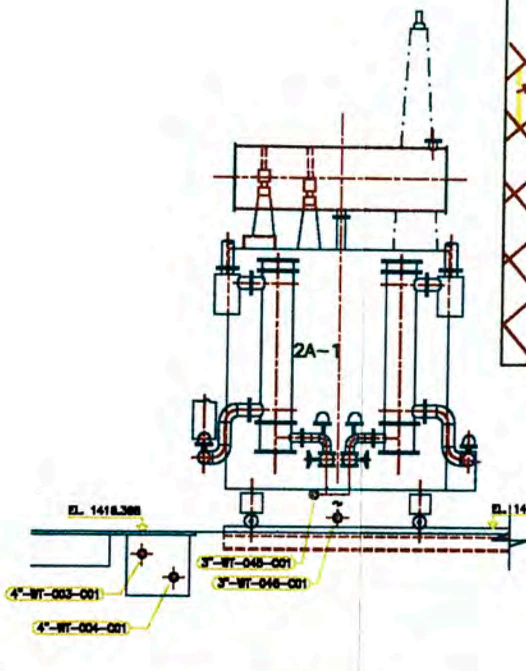
GyM S.A.



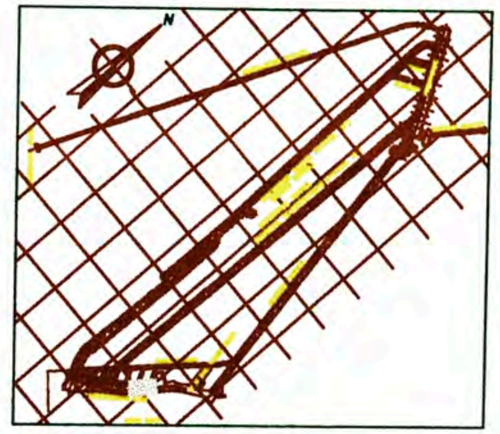
SECTION (A)
ESC. 1/50 ET-25 Sh1/2



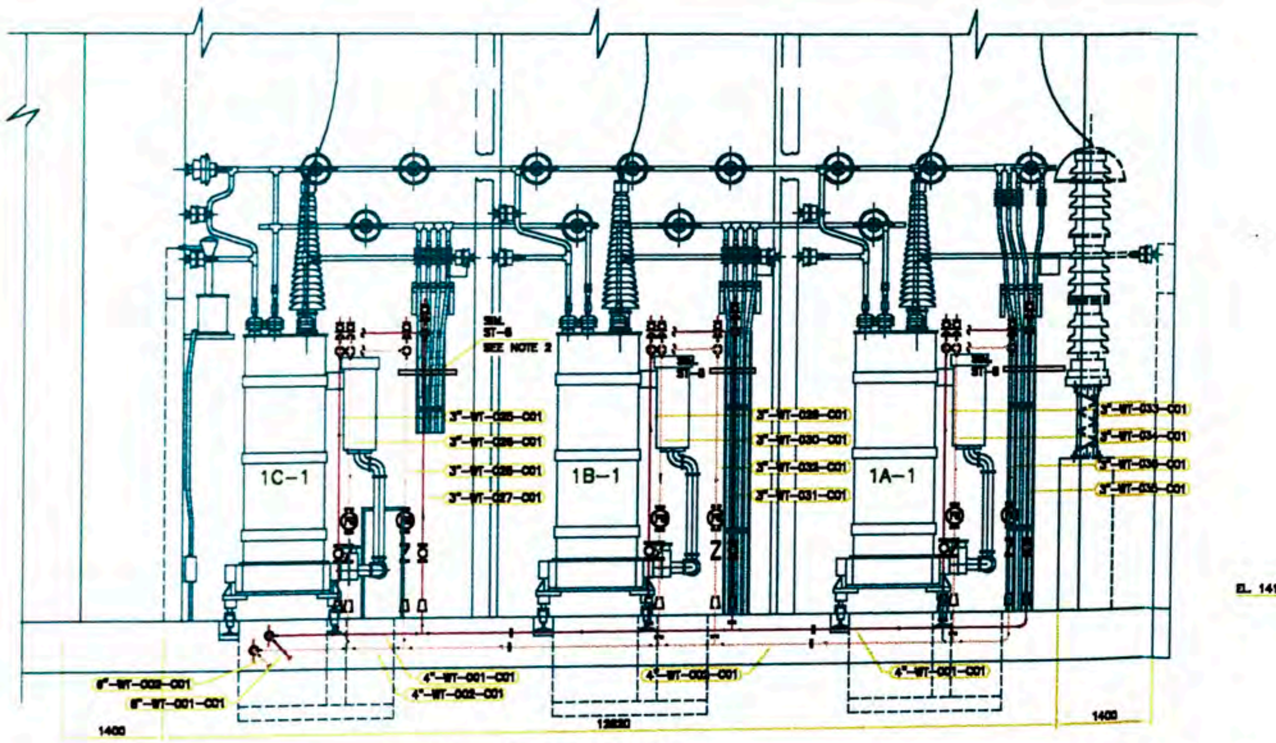
SECTION (D)
ESC. 1/50 ET-25 Sh1/2



SECTION (E)
ESC. 1/30 ET-25 Sh1/2



KEY PLAN



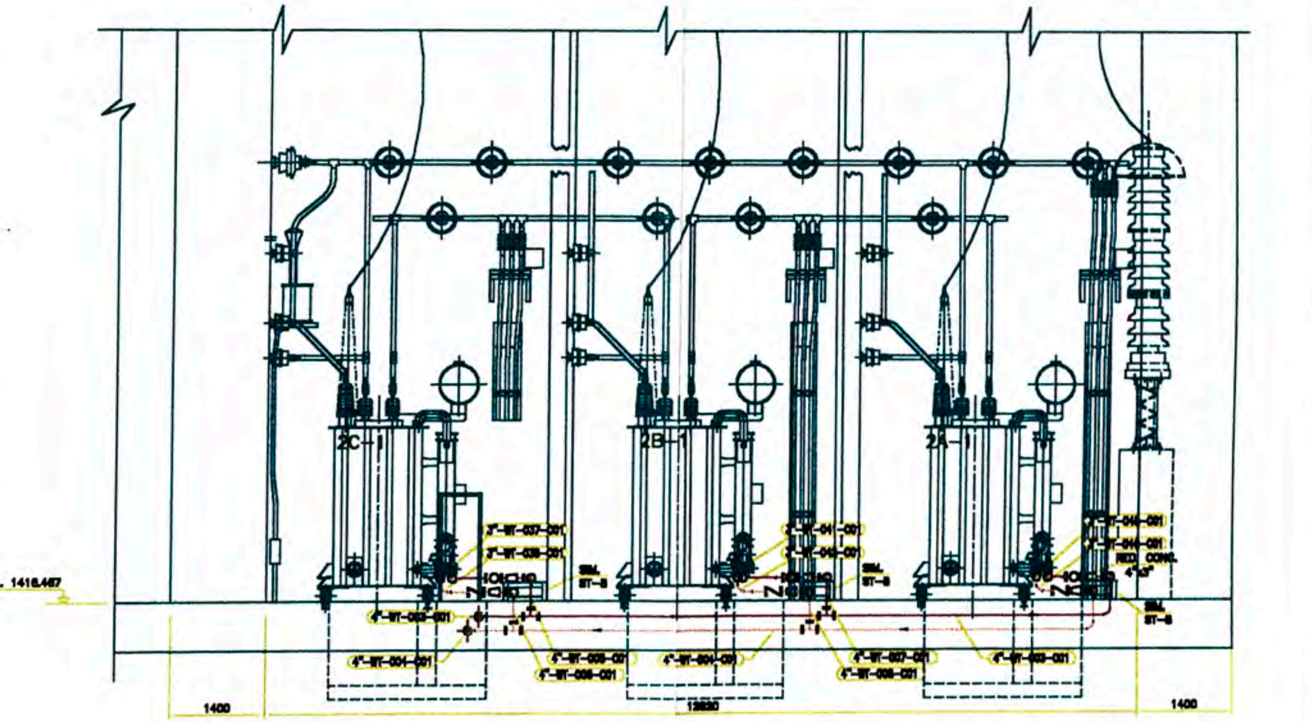
FRONT VIEW TO BANK N° 1

SECTION (B)
ESC. 1/50 ET-25 Sh1/2

NOTE :

1.- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS IN METERS.

2.- FOR SUPPORTS SEE DRAWING ET-31 Sh1 & 2.



FRONT VIEW TO BANK N° 2

SECTION (C)
ESC. 1/50 ET-25 Sh1/2

AS BUILT DRAWING

REFERENCE DRAWING

ET-25 Sh1/2	TRANSFORMER COOLING WATER SYSTEM – GENERAL ARRANGEMENT PIPING – PLAN – TRANSFORMER BANK N°1 & N°2
ET-26	TRANSFORMER COOLING WATER SYSTEM – GENERAL ARRANGEMENT PIPING – PLAN AND SECTIONS – TRANSFORMER BANK N°3
ET-31 Sh1 & 2	STANDARDS OF SUPPORTS
EE-087A	TRANSFORMERS BANK 1 AND 2 ARRANGEMENT GENERAL

PROJECT CODE: 1289	FILE: ET00025A
DESIGNED: E. VEGAS	DRAWING CAD: [illegible]
CHECKED: F. CUYA R.	
APPROVED: A. OLANDE F.	

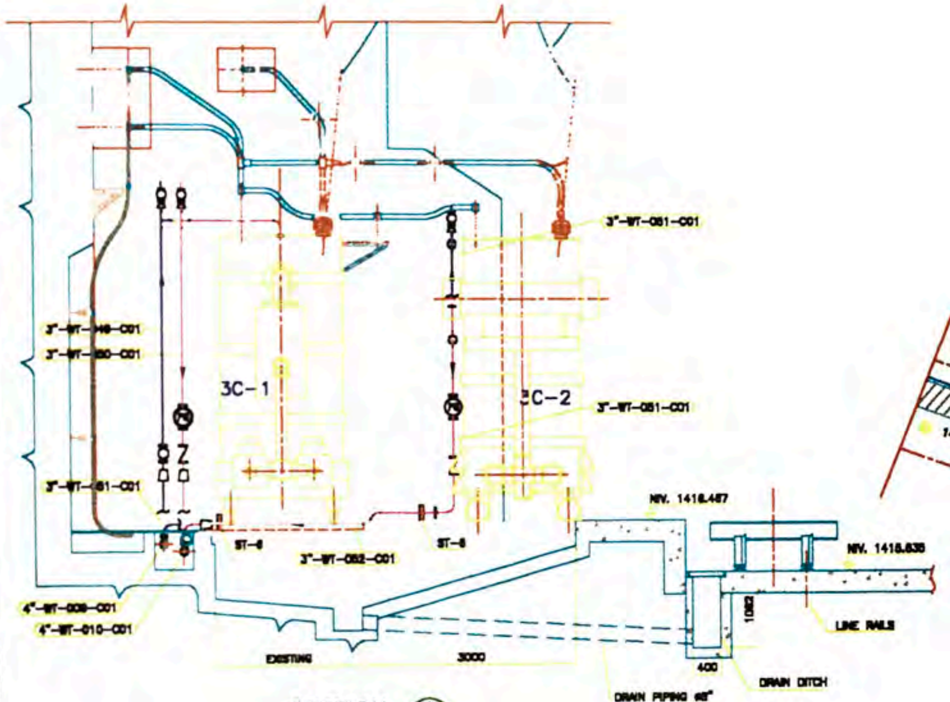
ABB POWER GENERATION INC.

GyM S.A.

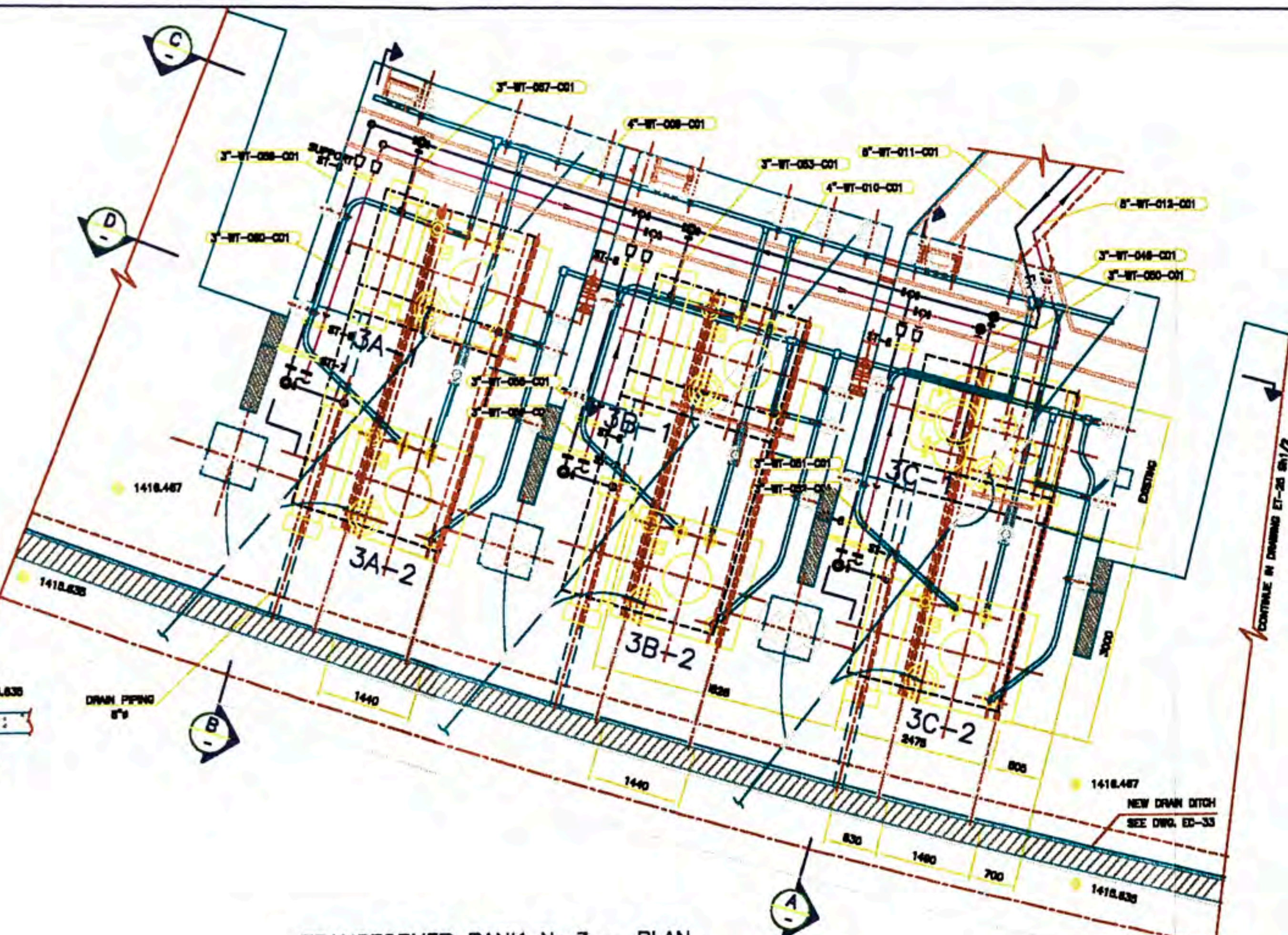
PROJECT: **EGENOR S.A.**
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

TITLE: TRANSFORMER COOLING WATER SYSTEM
GENERAL ARRANGEMENT–PIPING–SECTIONS
TRANSFORMES BANK 1 AND 2

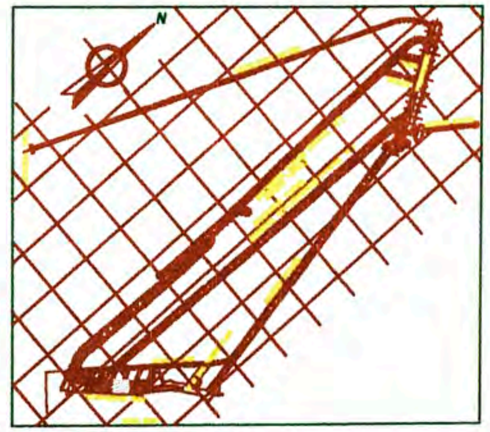
SCL: 1/50	CODE: ET-25 Sh2/2	REV. No 1
DATE: AUG.'98		

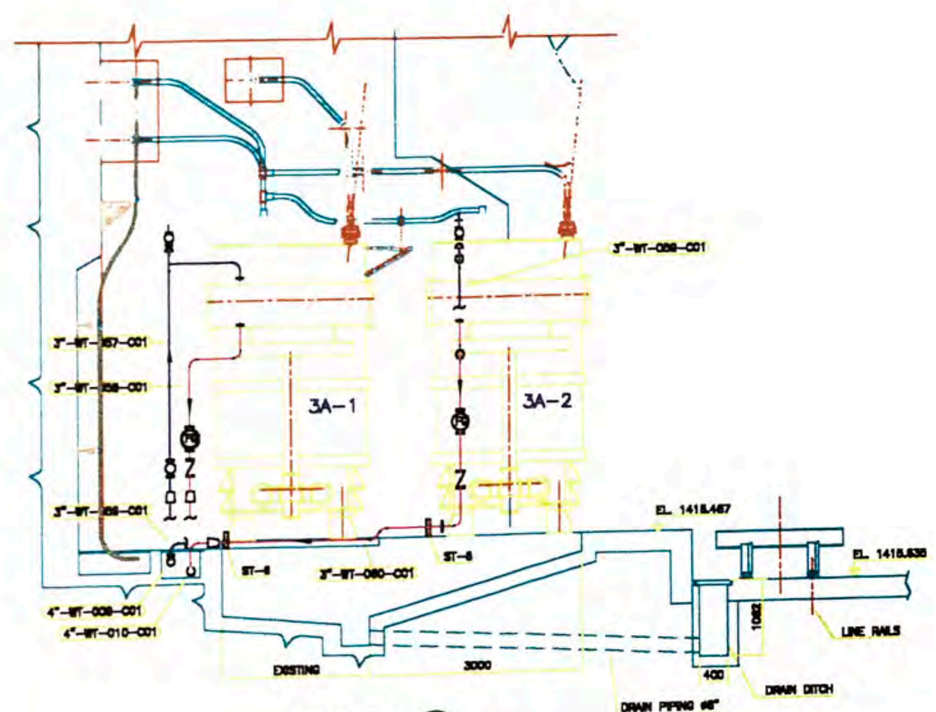


SECTION (A)
ESC. 1/50

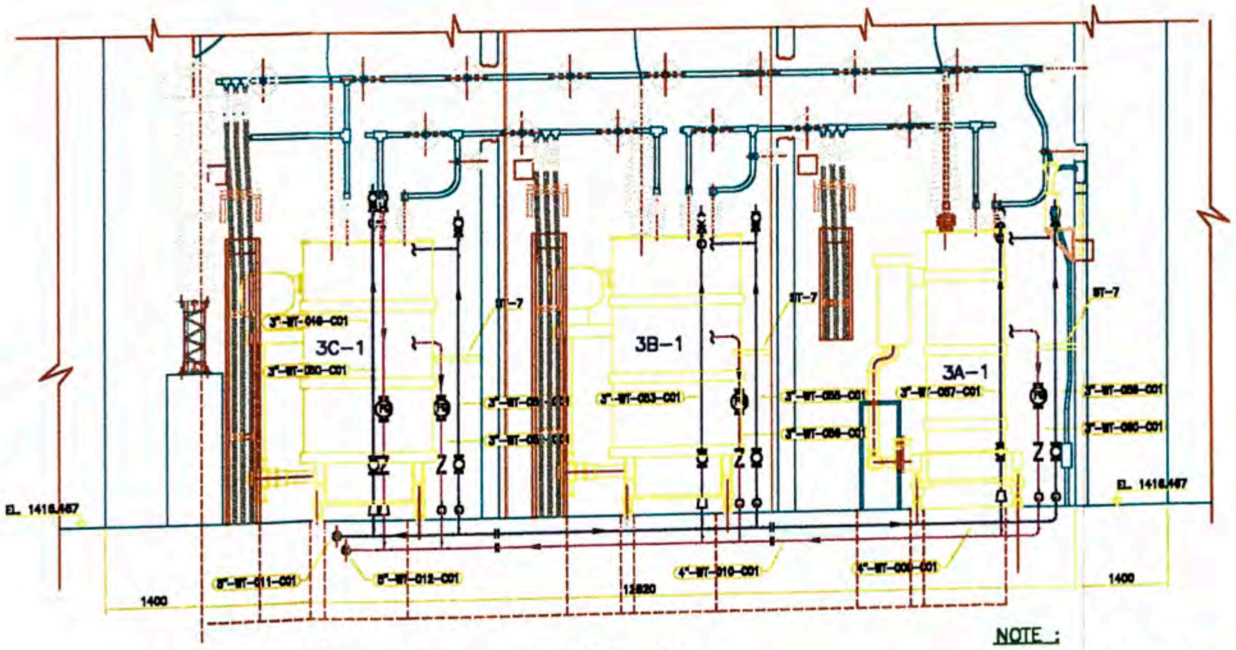


TRANSFORMER BANK No.3 – PLAN
ESC. 1/50

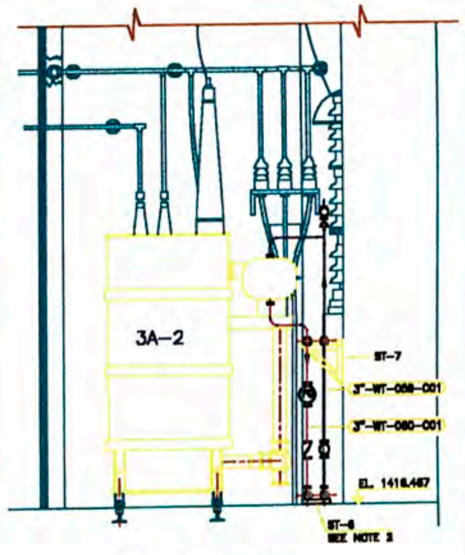




SECTION (B)
ESC. 1/50



SECTION (C)
ESC. 1/50



SECTION (D)
ESC. 1/50

NOTE :

1.– ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS IN METERS.
2.– FOR SUPPORTS SEE DRAWING ET-31 Sh1 & 2.

AS BUILT DRAWING

REFERENCE DRAWING

ET-25 Sh2/2	TRANSFORMER COOLING WATER SYSTEM – GENERAL ARRANGEMENT PIPING – PLAN – TRANSFORMER BANK N°1 & N°2
EE-088	TRANSFORMERS BANK N°3 – ARRANGEMENT GENERAL
EC-33	TRANSFORMER BANK OIL COLLECTION CHANNEL PLAN AND PROFILE
ET-31 Sh1 & 2	STANDARDS OF SUPPORT

PROJECT CODE: 1288	FILE: ET000026
DESIGNED: E. VEGAS	DRAWING CAD: R.HIDALGO/T.MEJIA
CHECKED: F. CUYA R.	
APPROVED: A. OLAVIDE P.	

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GMI S.A.

PROJECT:
EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

TITLE:
TRANSFORMER COOLING WATER SYSTEM
GENERAL ARRANGEMENT–PIPING–PLAN AND SECTIONS–TRANSFORMER BANK N°3

SCALE	CODE	REV. No
1/50	ET–26	1
DATE: AUG.'98		

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LINES OF INSTRUMENTS SYMBOLS

- PROCESS CONNECTION
- PNEUMATICAL SIGNAL
- ELECTRICAL CONNECTION
- CAPILAR TUBE (CLOSED SYSTEM)
- HYDRAULIC SIGNAL
- SONIC OR NUCLEAR SIGNAL
- SOFTWARE INTERCONNECTIONS

SERVICE CODE OF PIPING

AP	COMPRESSED AIR OF PLANT
AI	INSTRUMENTATION AIR
WR	RAW WATER
WT	TREATED WATER
OC	LUBE OIL
DC	CARBON DIOXIDE
OH	HIDRAULIC OIL

LIST OF VALVE CODES

1XX	: GATE
2XX	: GLOBE
3XX	: BALL
4XX	: CHECK
5XX	: NEEDLE
6XX	: BUTTERFLY
7XX	: SPECIAL

DESIGNATION OF PIPING

3"-WR-100-C02

- PIPE MATERIAL SPECIFICATION
- NUMBER OF LINE IDENTIFICATION
- SERVICE CODE
- PIPE DIAMETER (INCH)

SPECIFICATION OF PIPE MATERIAL

- C01 : PIPING OF STEEL WITH WELDING AND SCREWED CONNECTIONS.
- C02 : PIPING OF STEEL WITH VICTAULIC CONNECTIONS.
- C03 : PIPING OF STEEL RUBBERED WITH VICTAULIC CONNECTIONS.
- C04 : PIPING OF STEEL, THIN THICKNESS WITH WELDING CONNECTIONS.
- C05 : PIPING OF STEEL WITH WELDING CONNECTIONS.
- C06 : PIPING OF STEEL, THICK THICKNESS WITH WELDING CONNECTIONS.
- C07 : PIPING OF POLYETHYLENE WITH WELDING, FLANGED AND VICTAULIC CONNECTIONS.
- C08 : PIPING OF PVC WITH SCREWED AND WELDING CONNECTIONS.

VALVES NUMERATION

2-250

- END TYPE (SCREWED)
- VALVE TYPE (OF BALL)
- PRESSURE RANGE (CLASS 150)
- VALVE DIAMETER (INCHES)

SYMBOLS FOR ACTUATORS

- DIAPHRAGM (OPPOSITE SPRING)
- SOLENOID
- MOTOR (ELECTRICAL SIGNAL)
- CYLINDER OF SIMPLE ACTION WITHOUT POSITIONER
- CYLINDER OF DOUBLE ACTION
- CYLINDER WITH RETURN FOR SPRING (FAIL OPEN OR CLOSED)
- ELECTRIC – HIDRAULIC

AUXILIARY SYMBOLS

- INSULATED LINE (PERSONNEL PROTECTION)
- INSULATED LINE (THERMIC INSULATION)
- INSULATED LINE (ELECTRIC TRACING)
- CHANGE OF PIPE MATERIAL (ESPEC.)
- GATE VALVE (NO)
- GATE VALVE (NC)
- GLOBE VALVE
- CHECK VALVE
- STOP CHECK VALVE
- BUTTERFLY VALVE
- PLUG VALVE
- ANGLE GLOBE VALVE
- BALL VALVE
- DIAPHRAGM VALVE
- NEEDLE VALVE
- RELIEF SAFETY VALVE
- 3 WAYS VALVE
- 4 WAYS VALVE
- PURGE VALVE, FAST CLOSE
- "Y" VALVE SLOW CLOSE
- FILTER TYPE "Y"
- VICTAULIC CAP
- END LINE CAP
- SCREWED CAP
- SCREWED PLUG
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- FLOOR DRAIN
- WELDING NECK FLANGE
- SLIP ON FLANGE
- BLIND FLANGE
- ORIFICE FLANGE
- WELDED ELBOW
- SOCKET ELBOW
- SCREWED ELBOW
- POINT FOR PRESSURE INTAKE
- FLEXIBLE HOSE
- EXPANSION JOINT
- VICTAULIC COUPLING
- TO CONTINUE IN THE DRAWING
- BASKET FILTER
- DRAIN OPEN
- STATION OF AIR HOSE
- STATION OF WATER HOSE
- LUBRICATOR
- LINE FILTER
- FILTER OF DOUBLE BASKET
- GLASS SIGHT FOR FLOW

ABBREVIATIONS

A/M	– AUTOMATIC / MANUAL
ARR.	– ARRANGEMENT
BR.	– FLANGE
C.F.	– FLAT FACE
C/R	– W/LINED
C.R.	– RAISED FACE
CAP.	– CAPACITY
CONEX.	– CONNECTION
CONC.	– CONCENTRIC
CONT.	– CONTINUATION
℄	– CENTER LINE
DET.	– DETAIL
D.E.	– OUTSIDE DIAMETER
D.I.	– INSIDE DIAMETER
D.N.	– NOMINAL DIAMETER
ø	– DIAMETER
E.B.	– BEVEL END
E.P.	– FLAT END
E.R.	– THREADED END
EXC.	– ECCENTRIC
EXP.	– EXPANSION
FLEX.	– FLEXIBLE
FLT.	– FILTER
gal.	– GALON
h	– HOUR
I	– CURRENT
kPa.	– KILO PASCAL
min.	– MINUTE
m	– METER
NA.	– NORMAL OPEN
NC.	– NORMAL CLOSED
NIT.	– LOWER LEVEL OF PIPE
TOS.	– TOP LEVEL OF STEEL
TRC.	– TOP LEVEL OF CONCRETE
PT.	– WORK POINT
psi	– pounds/sq. in.
O.C.	– CHAIN OPERATED
RED.	– REDUCER
S.O.	– SLIP ON
S/E	– WITHOUT/SCALE
SIC.	– UNLESS CONTRARY INDICATION
SIM.	– SIMILAR
ST.	– PIPE SUPPORT
TC	– THERMOCOUPLE
TIP.	– TYPICAL
TQ.	– TANK
TUB.	– PIPING
VAL.	– VALVE
W.N.	– WELDING NECK

SYMBOLS OF GENERAL INSTRUMENTS

- CONTROL PLC
- FUNCTION OF CONTROL SYSTEM
- INSTRUMENT – LOCAL MOUNTED
- INSTRUMENT – MOUNTED IN MAIN CONTROL
- INSTRUMENT – 2 VARIABLES OR DOUBLE FUNCTION
- EXISTING INSTRUMENT
- INSTRUMENT – VENDOR SUPPLIED
- INSTRUMENT – MOUNTED IN AUXILIARY PANEL
- PILOT LIGHT
- INTERLOCK
- INSTRUMENTS MOUNTED IN LINE
- CONTROL VALVE
- SOLENOID VALVE
- SOLENOID VALVE 3 WAYS
- CONTROL VALVE 3 WAYS
- REGULATOR REDUCER OF PRESSURE – COMPLETE
- REGULATOR OF BACKPRESSURE
- MOTOR OPERATED VALVE
- FLOW METER – TYPE TURBINE
- FLOW METER – TYPE WITH TOTALIZING
- FLOW METER
- ROTAMETER
- PRESSURE GAUGE

SYMBOLS OF EQUIPMENT

- FEED PUMP
- POSITIVE DISPLACEMENT PUMP
- CENTRIFUGAL PUMP

RANGE OF PRESSURE

1	CLASS 125
2	CLASS 150
3	CLASS 250
4	CLASS 300
5	CLASS 500
6	CLASS 3000 AND BIGGER

TYPE OF VALVE

BA	BALL
BU	BUTTERFLY
CH	CHECK
DM	DIAPHRAGM
GA	GATE
GL	GLOBE
NE	NEEDLE
PN	PINCH
PL	PLUG
KN	KNIFE

END TYPE

01 TO 20	SCREWED
21 TO 40	SOCKET TYPE
41 TO 60	BUTT WELDED
61 TO 80	VICTAULIC
81 TO 99	FLANGED

TABLA 1

LETTER IDENTIFICATION (IDENTIFICACION DE LETRA)

	FIRST LETTER (PRIMERA LETRA)		SUCCESSIVE LETTERS (LETRAS SUCESIVAS)		
	MEASURED OR INITIAL VARIABLE (MEDIDA O VARIABLE INICIAL)	MODIFIER (MODIFICADOR)			MODIFIER (MODIFICADOR)
A	ANALYSIS (ANALISIS)		ALARM (ALARMA)		
B	BURNER, COMBUSTION (QUEMADOR,COMBUSTION)				
C	CONDUCTIVITY (CONDUCTIVIDAD)			CONTROL	
D	DENSITY OR SPECIFIC GRAVITY (DENSIDAD O GRAVEDAD ESPECIFICA)	DIFFERENTIAL (DIFERENCIAL)			
E	VOLTAGE (VOLTAGE)		PRIMARY ELEMENT (ELEM. PRIMARIO)		
F	FLOW (FLUJO)	RATIO (RAZON)			
G	GAUGING (MANOMETRO ANALOG.)		GLASS (VISOR)		
H	HAND OPERATED (OPERADO MANUALMENTE)				HIGH (ALTO)
I	CURRENT (CORRIENTE)		INDICATE (INDICAD.)		
J	POWER (FUERZA)	SCAN (RASTREAR)			
K	TIME (TIEMPO)			CONTROL STATION (ESTACION DE CONTROL)	
L	LEVEL (NIVEL)		LIGHT(PILOT) LUZ (PILOTO)		LOW (BAJO)
M	MOISTURE (HUMEDAD)				MIDDLE OR INTER. (MEDIO o INTERM.)
N	UNDEFINED (INDEFINIDO)		UNDEFINED (INDEFINIDO)		
O	OPERATION (OPERACION)		ORIFICE (RESTRICT.) ORIFICIO (RESTRICT.)		
P	PRESSURE OR VACUUM (PRESION O VACIO)		POINT (T. CONNECT) PUNTO (CONEXION DE PRUEBA)		
Q	QUANTITY (CANTIDAD)	INTEGRATE OR TOTALIZE (INTEGRAR O TOTALIZAR)			
R	RADIOACTIVITY (RADIOACTIVIDAD)		RECORD (REGISTRO)		
S	SPEED OR FREQUENCY (VELOCIDAD O FRECUENCIA)	SAFETY (SEGURIDAD)		SWITCH (CONTACTOR)	
T	TEMPERATURE (TEMPERATURA)			TRANSMIT (TRANSMITIR)	
U	MULTIVARIABLE (MULTIVARIABLE)		MULTIFUNCTION (MULTIFUNCION)		
V	VISCOSITY OR VIBRATION (VISCOSIDAD O VIBRACION)			VALVE OR DAMPER (VALVULA O DAMPER)	
W	WEIGHT, FORCE OR TORQUE (PESO, FUERZA O TORQUE)		WELL (POZO)		
X	UNDEFINED (INDEFINIDO)		UNDEFINED (INDEFINIDO)		
Y	EVENT, OR STATE (EVENTO, O ESTADO)			RELAY OR COMPUTER (RELE o COMPUTADORA)	
Z	POSITION, DIMENSION (POSICION, DIMENSION)			DRIVE ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT (ACTUADOR MOTORIZADO)	

AS BUILT DRAWING

PROJECT CODE: 1288	FILE: ET000030
DESIGNED: F. CUYA R.	DRAWING CHD.: VILLANUEVA/CHERO
CHECKED: J. FERNANDEZ	
APPROVED: A. OLAVIDE P.	

ABB
POWER GENERATION INC.

GyM S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

TITLE: LEGEND AND SYMBOLS

SCALE: N/S	CODE: ET–30	REV. No: 0
DATE: AUG.'98		

GyM
GyM S.A.

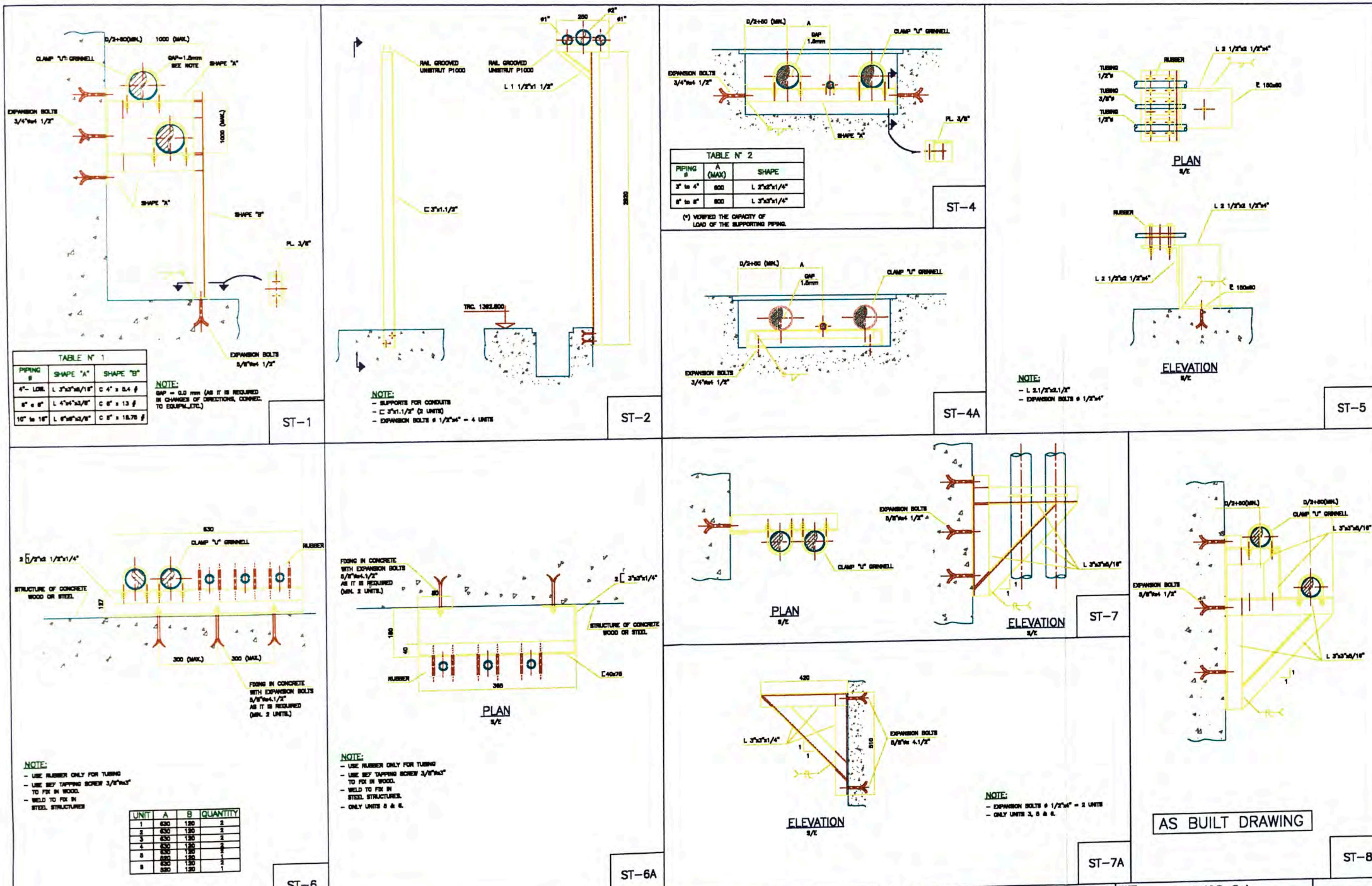


TABLE N° 1

PIPING Φ	SHAPE "A"	SHAPE "B"
4"- LOW.	L 3"x3"x5/16"	C 4" x 5.4 #
6" a 8"	L 4"x4"x3/8"	C 6" x 13 #
10" to 16"	L 6"x6"x3/8"	C 8" x 18.75 #

NOTE:
GAP = 0.0 mm (AS IT IS REQUIRED IN CHANGES OF DIRECTIONS, CONNEC. TO EQUIPM.,ETC.)

NOTE:
- SUPPORTS FOR CONDUITS
- C 3"x1.1/2" (2 UNITS)
- EXPANSION BOLTS Φ 1/2"x4" - 4 UNITS

TABLE N° 2

PIPING Φ	A (MAX)	SHAPE
3" to 4"	600	L 2"x2"x1/4"
6" to 8"	800	L 3"x3"x1/4"

(*) VERIFIED THE CAPACITY OF LOAD OF THE SUPPORTING PIPING.

NOTE:
- L 2.1/2"x2.1/2"
- EXPANSION BOLTS Φ 1/2"x4"

NOTE:
- USE RUBBER ONLY FOR TUBING
- USE SEF TAPPING SCREW 3/8"Φx3" TO FIX IN WOOD.
- WELD TO FIX IN STEEL STRUCTURES

UNIT	A	B	QUANTITY
1	630	120	2
2	630	120	2
3	630	120	2
4	630	120	2
5	630 320	120 120	2 1
6	630 320	120 120	2 1

NOTE:
- USE RUBBER ONLY FOR TUBING
- USE SEF TAPPING SCREW 3/8"Φx3" TO FIX IN WOOD.
- WELD TO FIX IN STEEL STRUCTURES.
- ONLY UNITS 5 & 6.

NOTE:
- EXPANSION BOLTS Φ 1/2"x4" - 2 UNITS
- ONLY UNITS 3, 5 & 6.

PROJECT CODE: 1269	FILE: ET000031
DESIGNED: F. CUYA	DRAWING CAD.: L.HIDALGO/T.MERA
CHECKED: J. FERNANDEZ	
APPROVED: A. OLAVIDE	

ABB POWER GENERATION INC.

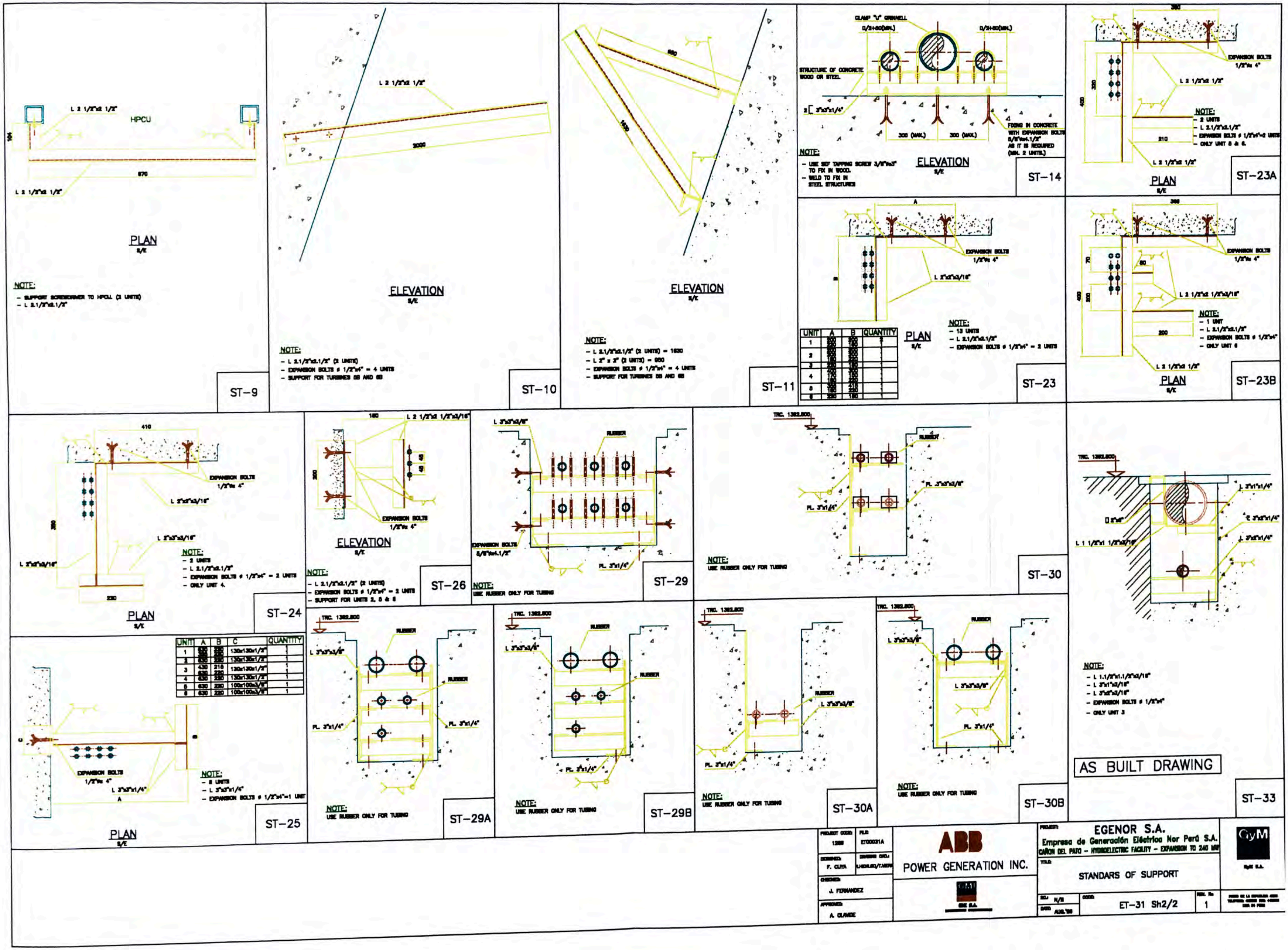
GMI S.A.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW

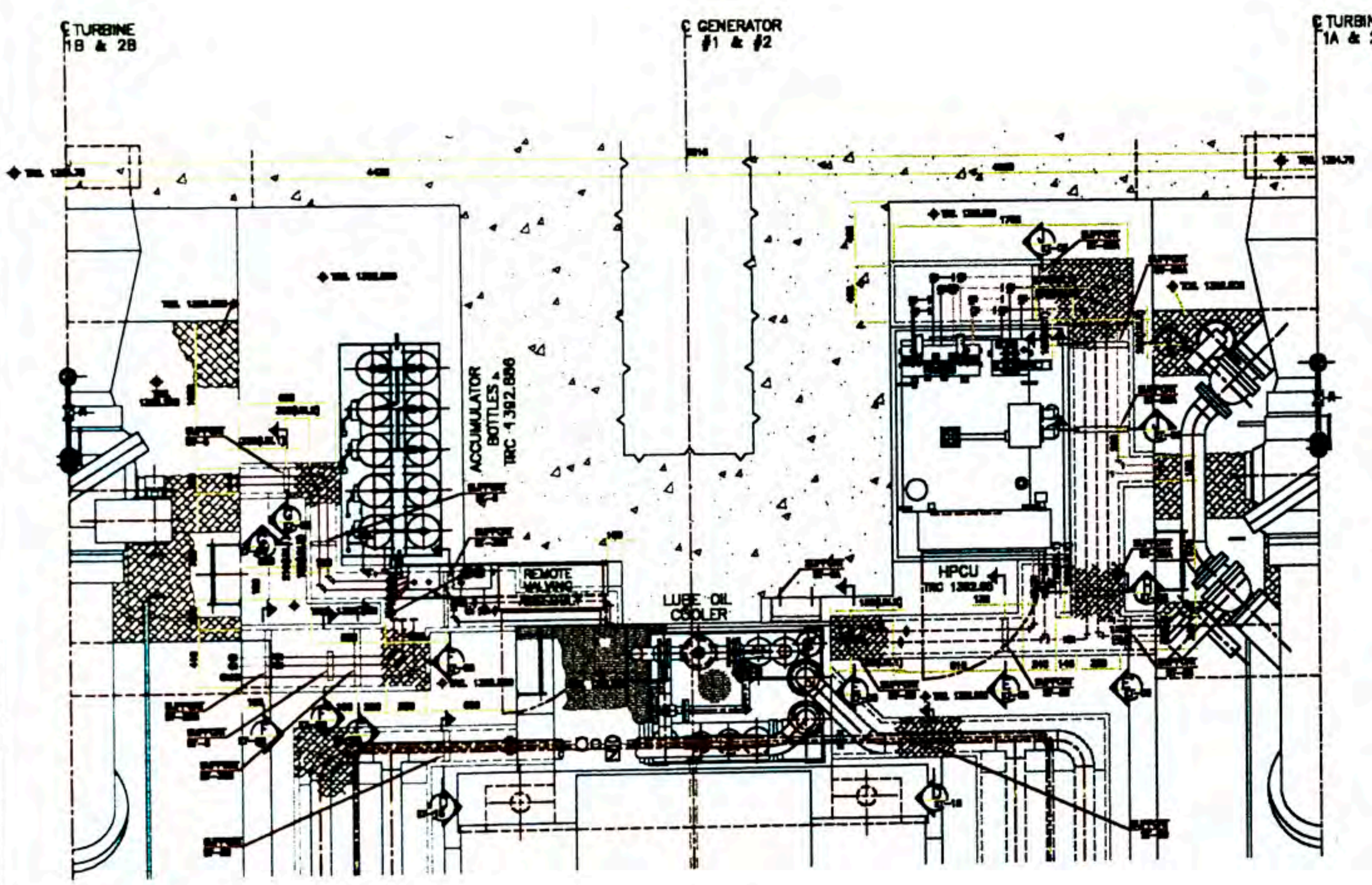
TITLE: STANDARS OS SUPPORT

SCL.: N/S	CODE: ET-31 Sh1/2	REV. No 1
DATE: AUG.'98		

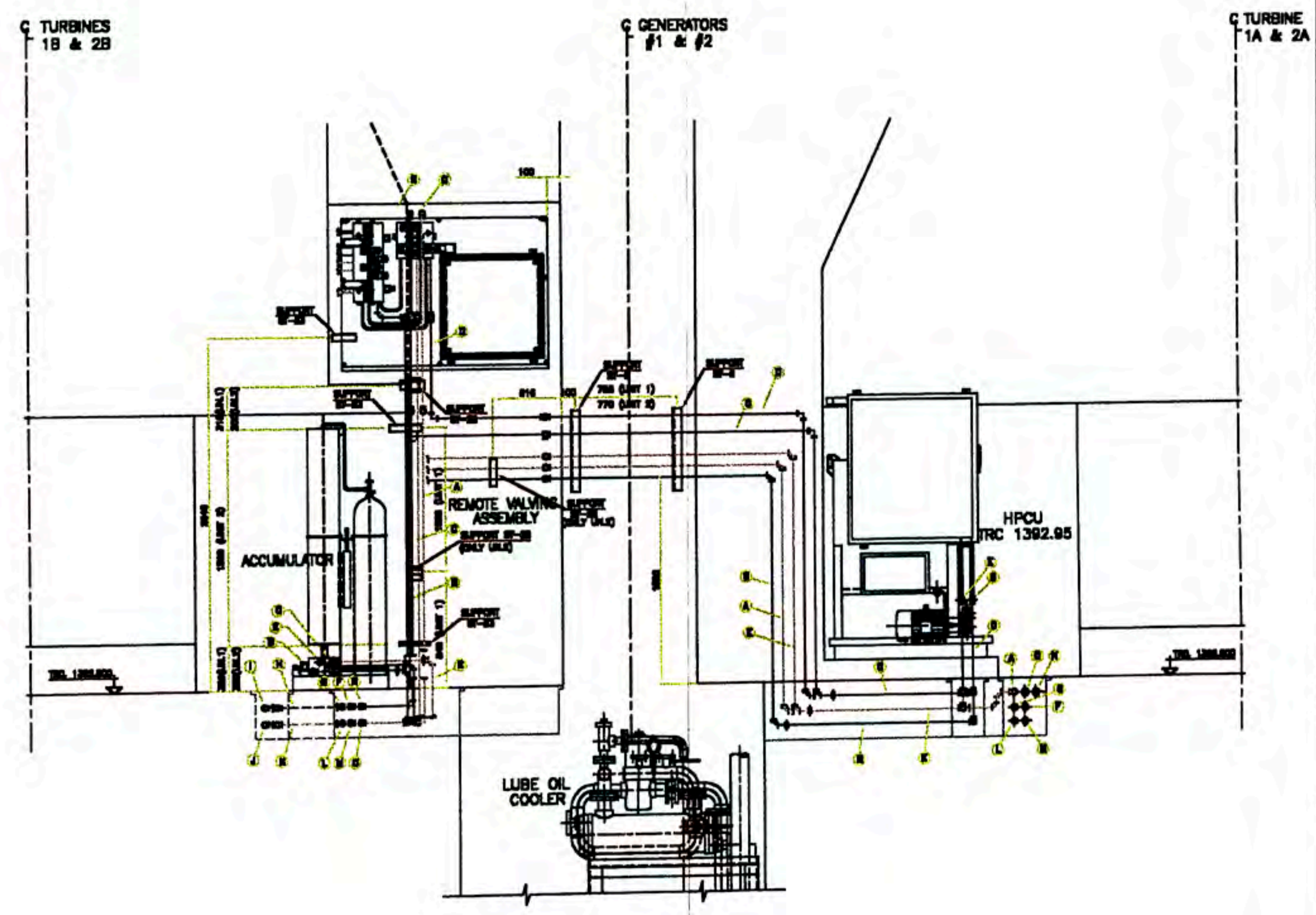
GyM S.A.



PLAN S/E
NOTE:
- SUPPORT SCREENFORMER TO HPCU (2 UNITS)
- L 2.1/2"x2.1/2"
HPCU
ST-9
ELEVATION S/E
NOTE:
- L 2.1/2"x2.1/2" (2 UNITS)
- EXPANSION BOLTS ø 1/2"x4" = 4 UNITS
- SUPPORT FOR TURBINES 5B AND 6B
ST-10
ELEVATION S/E
NOTE:
- L 2.1/2"x2.1/2" (2 UNITS) = 1630
- L 2" x 2" (2 UNITS) = 550
- EXPANSION BOLTS ø 1/2"x4" = 4 UNITS
- SUPPORT FOR TURBINES 5B AND 6B
ST-11
CLAMP "U" GRINNELL
STRUCTURE OF CONCRETE WOOD OR STEEL
ELEVATION S/E
NOTE:
- USE SEF TAPPING SCREW 3/8"x3" TO FIX IN WOOD.
- WELD TO FIX IN STEEL STRUCTURES
ST-14
PLAN S/E
EXPANSION BOLTS 1/2"ø 4"
NOTE:
- 2 UNITS
- L 2.1/2"x2.1/2"
- ONLY UNIT 5 & 6.
ST-23A
PLAN S/E
NOTE:
- 13 UNITS
- L 2.1/2"x2.1/2"
- EXPANSION BOLTS ø 1/2"x4" = 2 UNITS
UNIT A B QUANTITY
ST-23
PLAN S/E
NOTE:
- 1 UNIT
- L 2.1/2"x2.1/2"
- ONLY UNIT 6
ST-23B
PLAN S/E
EXPANSION BOLTS 1/2"ø 4"
NOTE:
- 2 UNITS
- L 2.1/2"x2.1/2"
- EXPANSION BOLTS ø 1/2"x4" = 2 UNITS
- ONLY UNIT 4.
ST-24
ELEVATION S/E
NOTE:
- L 2.1/2"x2.1/2" (2 UNITS)
- EXPANSION BOLTS ø 1/2"x4" = 2 UNITS
- SUPPORT FOR UNITS 2, 5 & 6
ST-26
RUBBER
NOTE: USE RUBBER ONLY FOR TUBING
ST-29
NOTE: USE RUBBER ONLY FOR TUBING
ST-30
NOTE:
- L 1.1/2"x1.1/2"x3/16"
- ONLY UNIT 3
AS BUILT DRAWING
ST-33
UNIT A B C QUANTITY
PLAN S/E
EXPANSION BOLTS 1/2"ø 4"
NOTE:
- 8 UNITS
- EXPANSION BOLTS ø 1/2"x4"=1 UNIT
ST-25
NOTE: USE RUBBER ONLY FOR TUBING
ST-29A
NOTE: USE RUBBER ONLY FOR TUBING
ST-29B
NOTE: USE RUBBER ONLY FOR TUBING
ST-30A
NOTE: USE RUBBER ONLY FOR TUBING
ST-30B
ABB
POWER GENERATION INC.
EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW
STANDARS OF SUPPORT
ET-31 Sh2/2
1
F. CUYA
J. FERNANDEZ
A. OLMEDE
GyM



PLAN EL. 1392.80



SECTION A

GENERAL NOTES

AS BUILT DRAWING

REFERENCE DRAWING

PROJECT CODE: 1286	FILE: ET32Sh33
DESIGNED: GM/GyM	DRAWING CHCL: T. VIERA
CHECKED: A. CORDOVA	
APPROVED: A. OLAVIDE	

ABB

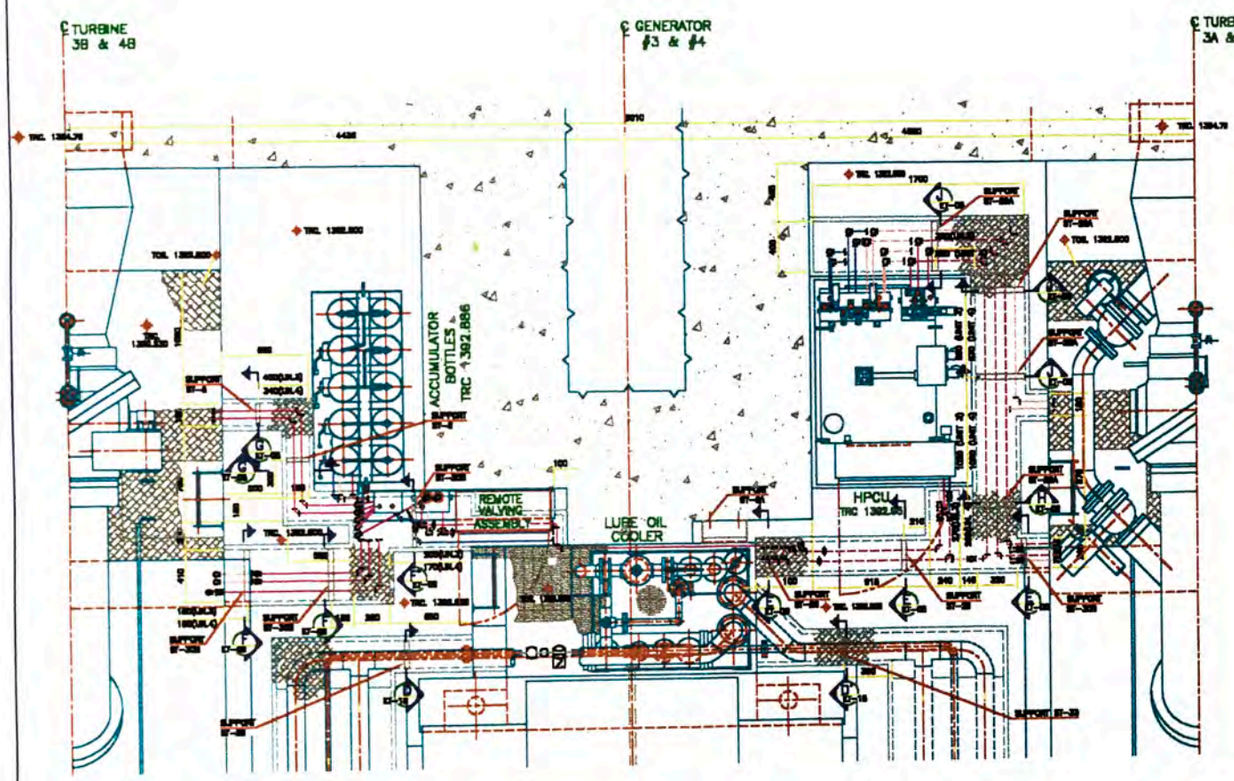
POWER GENERATION INC.

PROJECT: EGENOR S.A.
Empresa de Generación Eléctrica Nor Perú S.A.
CAÑON DEL PATO – HYDROELECTRIC FACILITY – EXPANSION TO 240 MW

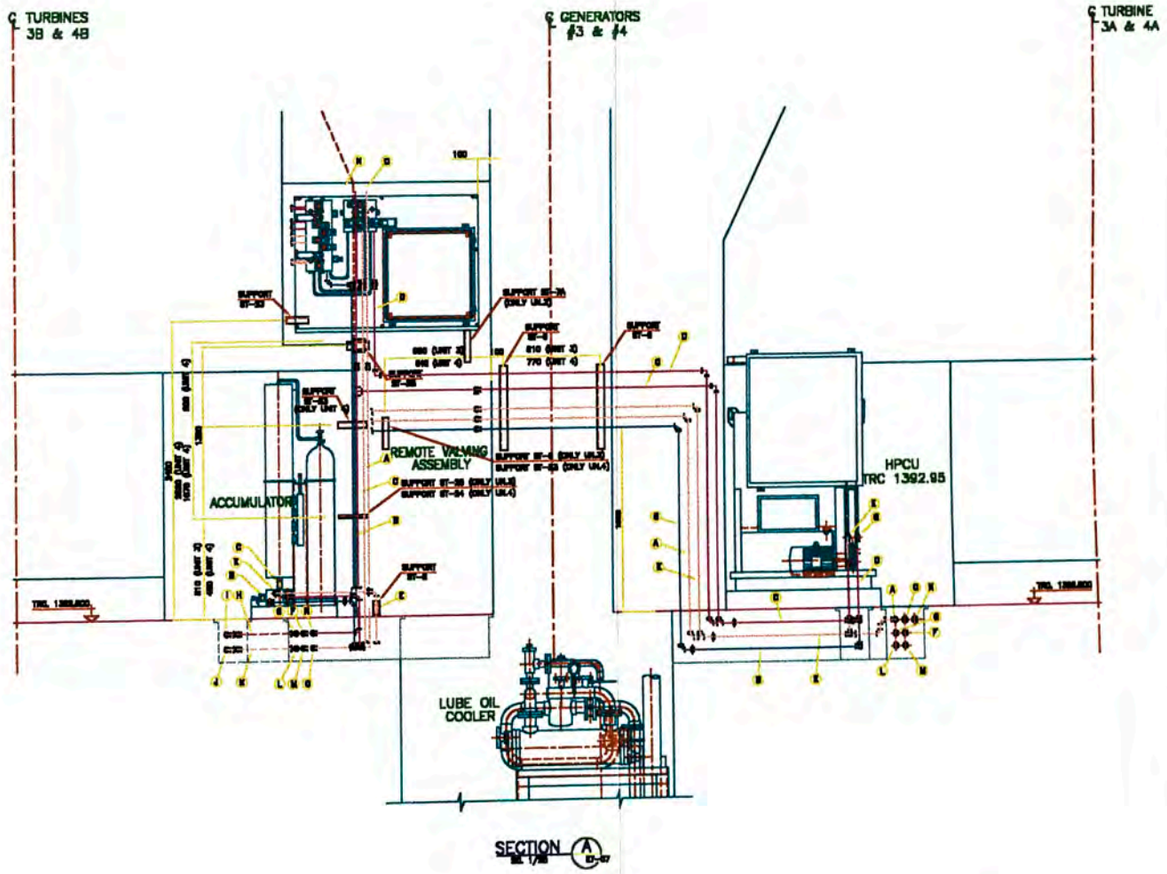
TITLE: POWERHOUSE
GENERATORS N°1 & N°2
DISTRIBUTION OF SUPPORTS

SCL: 1/20 | DATE: AUG.'98 | CODE: ET–32 Sh1/3 | REV. No: 0

GyM S.A.



PLAN EL. 1392.80
SC. 1/20



SECTION A ET-07
SC. 1/20

GENERAL NOTES

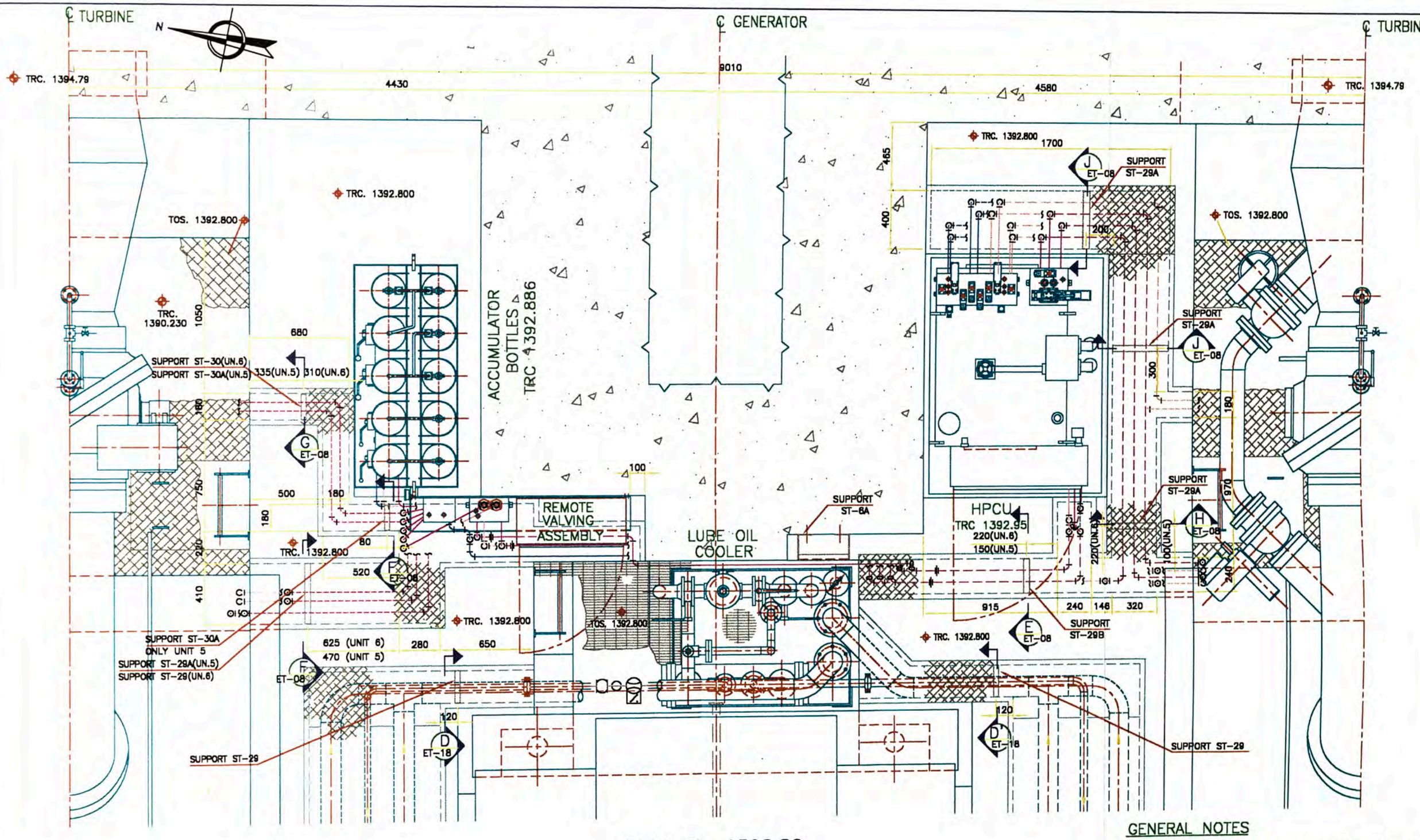
1.- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS IN METERS.
2.- FOR SUPPORTS SEE DRAWING ET-31 Sh1 & 2.

REFERENCE DRAWING

ET-07 TURBINES AND GENERATORS - HYDRAULIC POWER CONTROL UNIT - PIPING - PLAN
ET-31 Sh1 & 2 STANDARDS OF SUPPORT
ET-05 TURBINES AND GENERATORS - HYDRAULIC POWER CONTROL UNIT - PIPING - SECTIONS

AS BUILT DRAWING

PROJECT CODE: 1288	FILE: ET32Sh33	ABB POWER GENERATION INC.	PROJECT: EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CAÑON DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW
DESIGNED: GM/GyM	DRAWING ONLY: T. VIERA		TITLE: POWERHOUSE GENERATORS N°3 & N°4 DISTRIBUTION OF SUPPORTS
CHECKED: A. CORDOVA			GyM S.A.
APPROVED: A. OLAVIDE			SC.: 1/20 DATE: AUG.'98 CODE: ET-32 Sh2/3 REV. No: 0



PLAN EL. 1392.80

GENERAL NOTES

1.- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS IN METERS.

2.- FOR SUPPORTS SEE DRAWING ET-31 Sh1 & 2.

AS BUILT DRAWING

REFERENCE DRAWING

ET-07	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PIPING – PLAN
ET-08	TURBINES AND GENERATORS – HYDRAULIC POWER CONTROL UNIT – PIPING – SECTIONS
ET-31 Sh1 & 2	STANDARDS OF SUPPORT

PROJECT CODE: 1288	FILE: ET32SH33	ABB POWER GENERATION INC.	EGENOR S.A. Empresa de Generación Eléctrica Nor Perú S.A. CARHUAQUERO DEL PATO - HYDROELECTRIC FACILITY - EXPANSION TO 240 MW
DESIGNED: GM/GyM	DRAWING CAD: T. VIERA		TITLE: POWERHOUSE GENERATORS N°5 & N°6 DISTRIBUTION OF SUPPORTS
CHECKED: A. CORDOVA			GyM S.A.
APPROVED: A. CLAVIJO		SCALE: 1/25	CODE: ET-32 Sh3/3
		DATE: AUG.'98	REV. No: 0