UNIVERSIDAD NACIONAL DE INGENIERIA
FACULTAD DE INGENIERIA QUIMICA Y MANUFACTURERA

TEÑIDO DE ALGODON POR EL SISTEMA DE BOBINAS CRUZADAS, SISTEMA PAD BATCH Y TENIDO CON INDIGO

INFORME TECNICO
PARA OBTENER EL TITULO PROFESIONAL DE
INGENIERO QUIMICO

PRESENTADO POR:
ENRIQUE PIO RIOS ZARZOSA
PROMOCION 80-1

UNI, MAYO DE 1998

..... a mis padres por su apoyo incondicional y un agradecimiento muy especial a todos los colaboraron en mi formación educativa.

CONTENIDO:

I.-TEÑIDO DE ALGODÓN EN BOBINAS CRUZADAS

EMPRESA: COTTON DESIGNS S. A.

DIRECCION: AV. HUAYLAS 1184 - CHORRILLOS

CARGO : JEFE DE LA PLANTA DE TINTORERIA

TIEMPO DE SERVICIO : CUATRO AÑOS
DEL 16/06/94 A LA FECHA

INDICE

1.- INTRODUCCION

COTTON DESIGNS S. A. Empresa dedicada al teñido de hilos de algodón en bobinas cruzadas ; su producción esta dirigida a Compañías Confeccionistas cuya producción; en mayor porcentaje llega al mercado internacionacional pues el mercado local es pequeño para este rubro.

¿que es teñir en bobinas cruzadas? Es colorear el algodón en bobinas perforadas, usando colorantes apropiados, inicialmente son preparadas en una sección denominada coneras; estas bobinas pueden ser cónicas o rectas en cuyo caso toma el nombre de quesos, esto se lleva acabo valiéndose de un equipo llamado autoclave; donde las bobinas se van acomodar en un portamaterial muy singular (ver apéndice fig. 01) en estos usos o mas conocido como espadas se apilan las bobinas unas sobre otras separadas por un plato intercalario denominado chapa; cargado el portamaterial, lo cual debe ser en su totalidad, se introduce en la autoclave valiéndose de un tecle. En la autoclave por intermedio de una bomba se hace circular baño de teñido en doble sentido y por lapsos preestablecidos (ver apéndice fig. 02).

Teñido el lote o partida las bobinas se centrifugan y se secan, luego se reenconan en conos desechables de cartón en los cuales se despacha el producto.

Es necesario indicar que todo teñido se inicia con muestras pequeñas que trae el cliente y que debe ser reproducida por el laboratorio de l a tintorería (Lab-dips) y aceptada por el cliente.

- FUNCIONES ASIGNADAS AL CARGO DESEMPEÑADO:

a.- ORGANIZAR TODO EL PROCESO PRODUCTIVO:
DESDE EL LABORATORIO HASTA EL EMBALAJE.

b.- APROBAR MATICES.

c.- DISEÑAR CURVAS DE TEÑIDO

d.- ESTABLECER PARAMETROS, DUREZA DE BOBINAS, PESOS POR PARTIDAS, TAMAÑO DE BOBINAS, FLUJOS.

e.- SELECCIONAR COLORANTES .

f.- REALIZAR LOS PEDIDOS DE COLORANTES , AUXILIARES DE TEÑIDO, Y PRODUCTOS QUIMICOS.

g.- ELABORAR CUADROS DE PERSONAL POR SECCION Y TURNO.

h.- IMPLEMENTAR NUEVOS EQUIPOS Y MAQUINARIA.

i.- COORDINAR LOS MANTENIMIENTOS ELECTRICOS Y MECANICOS DE TODA LA PLANTA.

j.- ELABORAR EL PROGRAMA DE PRODUCCION EN COORDINACION CON LA GERENCIA Y EL DPT. DE VENTAS.

k.- EVALUAR CONSTANTEMENTE NUEVOS PRODUCTOS, BUSCANDO MEJORAR LA CALIDAD DEL TEÑIDO Y MEJORAR LOS COSTOS.

- TIEMPO DE SERVICIOS: TRES AÑOS ONCE MESES.
DESDE EL 16/06/94 A LA FECHA.

tton Designs S.A.

Av. Huaylas 1184 - Chorrillos
Lima 9, Perú

☎ 251-0346 / 467-6277
Fax: 467-2046

CERTIFICADO DE TRABAJO

Por medio del presente documento certificamos que el Ing. Enrique Rios Zarzosa, trabaja en esta empresa ocupando el cargo de Jefe de la Planta de Tintoreria, Cargo que viene desempeñando con eficiencia desde el 16 de Junio de 1,994 hasta la acutalidad

Se expide el presente certificado a solicitud del interesado para los fines que estime convenientes.

Chorrillos, 29 de Octubre de 1,997.

COTTON DESIGNS S. A.

ALBERTO CAMBANA CORREA
GERENTE

2.- ACTIVIDAD PROFESIONAL

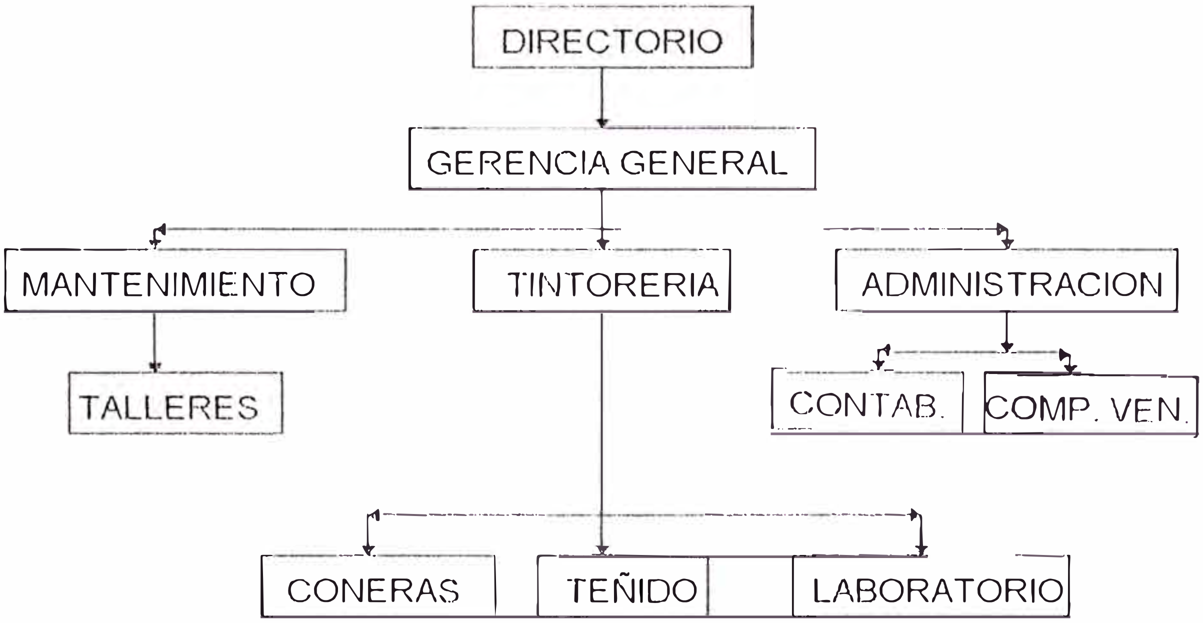
2.1.- EL ORGANO EMPRESARIAL.

-Nombre y razón social de la Empresa:. **COTTON DESIGNS S.A.**

-Dirección: Av. Huaylas 1184 Chorrillos.

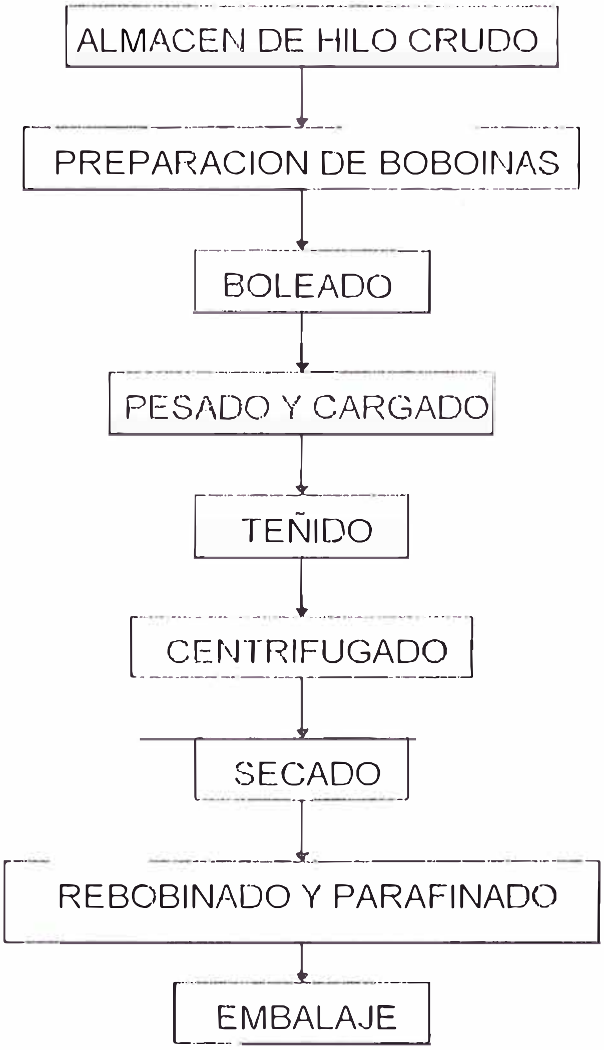
-Sector al cual pertenece: **SECTOR TEXTIL**.

-Estructura Orgánica:



-Línea de Producción: Teñido de hilo en Bobinas Cruzadas.

-DIAGRAMA DE FLUJO DE LAS UNIDADES DE PRODUCCIÓN:



2.2.- RELACION PROFESIONAL - EMPLEADOR.

-CONDICION : **CONTRATADO.**

2.3.- TRABAJO PROFESIONAL DESARROLLADO:

- **CARGO DESEMPAÑADO**: JEFE DE LA PLANTA DE TINTORERIA.

  RESPONSABLE DE LA JAFATURA DE TINTORERIA REPORTANDO DIRECTAMEN TE A LA GERENCIA GENERAL.

2.4.- TIPO DE TECNICAS DE INGENIERIA NECESARIOS PARA LA FUNCION DESEMPEÑADA

° Técnicas de teñidos.

° Técnicas de determinación cuantitativa de productos químicos; y preparación de soluciones.

° Técnicas de planeamiento de la producción.

° Estudios de tiempos y movimientos.

° Técnica de diseño de bombas.

° Cubicación de recipientes.

° Técnica de instalaciones de conexiones y accesorios de tuberías.

° Técnica de operación de ablandadores de agua.

° Técnica de diseño de intercambiadores de calor.

° Técnica de instalaciones eléctricas.

° Técnica de cálculo de la potencia de motores eléctricos.

- PERSONAL A CARGO:

° COLORISTAS: tres Ing° en Laboratorio y planta.	03
°JEFE DE ALMACEN: mas tres ayudantes.	04
° TINTOREROS: tres operarios mas diez ayudantes.	13
° JEFE DE CONERAS: mas once operarios.	12
° TRES eventuales todo servicio.	03

***total 35 trabajadores.

- FORMATOS USADOS DURANTE LOS PROCESOS:

° Registros diario de ingreso de hilado y Kardex (Almacén).

° Orden de producción (emitido por la Gerencia).

° Pedido de hilo crudo de la tintorería al almacén.

° Pedido de colorantes, auxiliares y productos químicos de tintorería al almacén de colorantes y productos.

- ° Hojas de Ruta de la partida o lote que se procesa.
- ° Programa diario de producción.
- ° Registro de proceso por Máquina Diario.
- ° Cuaderno de Supervisión de Planta.
- ° Receta por Color de la Partida.
- ° Ordenes de Compra y/o Servicios.
- ° Receta de Laboratorio y formatos internos.
- ° Informe Mensual de producción.

2.5.- OBJETIVOS, ALCANCES Y CARACTERISTICAS DE CADA ACTIVIDAD:

a.- ORGANIZAR TODO EL PROCESO PRODUCTIVO:

El teñido de una partida se inicia con el alcance de la muestra y aprobación de la reproducción en el Laboratorio por el Cliente. Esta reproducción se debe hacer por proceso viables a nivel de planta. Cada teñido de una partida involucra una secuencia de procesos la que se recapitula en una HOJA DE RUTA . Esta hoja debe ser diseñada por el Jefe de tintorería.

b.- APROBACION DE MATICES:

La reproducción de matices se desarrolla en el Laboratorio y estas deben ser alcanzadas a los clientes; previo visto bueno del Jefe de Tintorería.

c.- DISEÑO DE CURVAS DE TEÑIDO:

Son detalles de los procesos que involucran variables como tiempo, temperatura, concentraciones, dirección de flujos etc. y están gratificadas para su fácil comprensión. Todo esto se reduce en una RECETA.

d.- ESTABLECIMIENTO DE PARAMETROS:

Como dureza de las bobinas, esto dependiendo de que si es pima, tanguis, polialgodón etc; tamaño de bobinas y peso por partida. Tiempos máximos de reposo en húmedo. Tiempo de centrifugado y temperatura de secado, uso del tipo de parafina, y recomendaciones para el almacenamiento.

e.- SELECCIÓN DE COLORANTES:

De acuerdo a las exigencias del cliente se seleccionara los colorantes:

-Solidez al lavado.

-Solidez al frote húmedo y al frote seco.

-Solidez al mercerizado.

-El factor costo es importante.

-Uso que se dará al hilo teñido.

f.- PEDIDO DE COLORANTES AUXILIARES Y PRODUCTOS QUIMICOS:

Los pedidos por la forma en que se realizan pueden ser pedido directo o pedido local; el primero es el que se realiza vía importación y el segundo del mercado local. Estos pedidos se realizan mensualmente de acuerdo a los consumos promedios, los cuales deben ser estadísticamente tabulados y respetando las tendencias.

g.- DETERMINACION DE PERSONAL POR SECCION Y TURNO.

Mediante la técnica de estudio de tiempos y movimientos se determinará el numero de personas que debe destinar para cada sección. Este estudio consiste en la toma de tiempos, cronometrando cada parte de los procesos; como puede ser el boleado, cargado del portamaterial, centrifugado, etc. y la toma de tiempos de los movimientos o traslados del material teniendo en cuenta el número de personas que lo realizan originándose el termino "horas hombre" teniendo en consideración el nivel de preparación del personal.

h.- IMPLEMENTACION DE NUEVOS EQUIPOS Y MAQUINARIA:

Este punto es importante, pues en el campo textil la innovación tecnológica es determinante para la rentabilidad de los productos. Normalmente se debe actualizar la maquinaria cada diez años, no obstante el mercado esta supeditado a la moda y ésta cada vez es mas novedosa. Dependerá mucho de los técnicos para hacer cambios en la maquinaria antes de su total reemplazo.

i.- COORDINAR LOS MANTENIMIENTOS MECANICOS Y ELECTRICOS DE TODA LA PLANTA:

Junto con el Jefe de mantenimiento y la Gerencia se programara estas actividades de tal forma que no se afecte la producción o esta se vea efectada al mínimo.

k.- ELABORAR EL PROGRAMA DE PRODUCCION :

En coordinación con la Gerencia y el Dpto. de Ventas se elabora un programa semanal de teñido: lo cual puede ser modificado debido a múltiples factores; por ejemplo falta de hilado, falta de aprobación de matices, atraso por mantenimiento no programado, por reproceso de partidas, etc.

2.6.- PROBLEMÁTICA EMPRESARIAL:

La Empresa, en la actualidad afronta un problema de operatividad, debido a la menor demanda que se va acentuando a medida que pasa el tiempo; y esto se debe a que los clientes que son confeccionistas vienen instalando sus propias tintorerías , como ejemplos tenemos a GALPISA, TEXTIMAX, TEXTIL DEL VALLE, COTTON KNIT, o otras que han ampliado su tintorería en mas de un 100%, caso de TEXTIL SAN CRISTOBAL, TEXTILES POPULARES etc.

2.7.- COSTO DE LOS TEÑIDOS:

En lo que se refiere a costos es importante tener claro que los que definen el costo de un teñido son los siguientes:

-Cantidad de colorante.

-Tiempo de proceso por máquina.

-Costo de energia vapor-electricidad.

-costos fijos.

Existe un procedimiento simple para determinar los costos de teñido y esto se basa en la intensidad del mismo. Es decir un teñido puede ser :

-claro.

-medio.

-oscuro.

-intenso o especial.

Cada una de las intensidades tiene un precio promedio ya establecido en cada tintoreria, como referencia pueden ser tomados DE $ 2.80; 3.80; 4.90; y 5.25 respectivamente. Normalmente esta opción se toma cuando no se tiene la receta de laboratorio.

En los casos que se tenga la receta de laboratorio se elabora los **COSTOS PRE DETERMINADOS** que sirve de base para determinar el precio del teñido; en estos costos predeterminados se considera

-Costo de los colorantes.
-Costo de los productos químicos.
-Costo de los productos auxiliares.
-Costo de preparación y reenconado.
-Costo de secado.
-Costo de teñido.
-Gastos administrativos financieros y ventas.

A continuación reproducimos los COSTOS PRE DETERMINADOS para un color medio:

COSTO PRE DETERMINADO:

Cliente: T. San José	Cantidad: 1.00 kilos	Quim.Auxi.: S1	N° 980154
Titulo: 30/1	Tipo: REACTIVO	Color: ACERO	

Codigo	Descripción	Observa	Kilos Lab	Kilos Ajust.	P.U. US$/kl	Total US$
12510	Azul bte. Synozol R Sp.	KISCO	0.32	0.32	32.79	10.493
12506	Negro SYNOZOL B	KISCO	0.09	0.09	9.87	0.888
12509	Rojo Synozol HF6BN	KISCO	0.04	0.04	16.63	0.665
20201	Astranat A	ASTRO	2.80		2.30	6.440
20401	Ceranina HCS	CLARIANT	1.90		2.35	4.465
20402	Sandolub NVJ	CLARIANT	1.00		4.20	4.200
20501	Ukofix 550	CPPQ	0.50		5.25	2.620
20701	Antiespumin	PROQUITE	0.10		6.5	0.650
30101	Acido Acetico	MUN.QUIM.	0.60		1.05	0.630
30301	Carbonato de Na	QUIMISA	7.00		0.48	3.360
30602	Sal Refinada	QUIMPAC	80.00		0.08	6.456
30603	Soda caustica	QUI. AND	3.00		0.72	2.160
30701	Tripolifosfato de Na	QUIMISA	1.50		1.20	1.800

RESUMEN:	$
COSTO COLORANTES	0.120
COSTO PROD.QUIMICOS	0.144
COSTO PROD.AUXILIARES	0.184
COSTO CONERAS	0.383
COSTO SECADO	0.136
COSTO TEÑIDO	0.661
COSTO DE PRODUCCION	1.628
GTOS.ADM.FIN.Y VTAS.	0.810
COSTO PRE DETERMINADO	**2.440**

2.8.- DESARROLLO DE PROYECTOS

Dentro de lo que es desarrollo de Proyectos se distinguen dos tipos de proyectos:

- Proyecto a nivel de Empresa, el cual consiste en implementar una planta de confección. COTTON DESIGNS S A es una Empresa de servicio de teñido y no usa el hilo teñido para su propia producción de prendas sino que entrega todo su servicio a Empresas Confeccionistas, quienes tejen y elaboran las prendas.

Dentro de esta propuesta esta la confección de suéteres y chompas de algodón que es un mercado con proyección y menos explotados por ahora, en cambio lo que se refiere a la confección de polos y camisetas es un rubro con mucha competencia. Este proyecto se ha encargado a una Empresa de Asesoramiento que sabemos que esta trabajando.

- Los proyectos a nivel de tintorería donde se ha tenido plena participación se citan los siguientes:

° Mejoras de los equipos, la automatización necesaria de todas las autoclaves; consiste en la instalación de procesadores electrónicos que permita desarrollar curvas de teñido mas exactas dando como resultado un teñido mas uniforme mas reproducible y mas eficiente productivamente.

° Efectos especiales al hilado como caspeados, melange, policolores, teñido y no teñido, etc. efectos que se encuentran en desarrollo.

2.9.- DETALLES SOBRE LOS PROYECTOS PLANTEADOS

- **IMPLEMENTACION DE UNA PLANTA DE CONFECCIONES:** Las prendas de algodón tienen ventajas sobre las prendas de fibra artificial por su nobleza(3) y no causar ninguna alteración a la piel. Pero su poca difusión en el mercado nacional se debe al mayor precio que tiene con respecto a las fibras artificiales , pero esto se puede mejorar mejorando los costos de producción. La exportación de prendas de algodón es un rubro muy ventajoso pero exigente.

  Instalar una planta chompas y de suéteres significa la adquisición de telares y circulares específicos, remalladoras y cerradoras, lavadoras de prendas, centrifuga, secadora, vaporizadores, fuentes de vapor, agua blanda , energía eléctrica y aire comprimido, local que incluya ambientes de corte y otros detalles. La producción se tiene que dirigir al mercado internacional, que es un mercado mas estable, aunque ingresar en ello toma su tiempo y significa estar pendientes de las ferias internacionales (4). Este proyecto se ha encargado a una Empresa Asesora que viene trabajando actualmente. Tiene por finalidad también de dirigir el hilo teñido proveniente de la tintorería, asegurando una demanda permanente y trabajo en la tintorería.

- **MEJORAS DE LOS EQUIPOS:** Con respecto a la modernización de los equipos, se viene instalando microprocesadores en el tablero eléctrico de las autoclaves. Estos programadores vienen a ser computadores que van a controlar varios sistemas de control como de temperatura, volumen, gradientes de temperatura, presión, sentido de los flujos etc. todos Vs. el tiempo. Un sistema de control simple esta compuesto de un mecanismo de control(1) (comparador, controlador y set point), un elemento medidor de la variable y un elemento final de control. Actualmente estos equipos vienen listos para instalarlos; reduciéndose el problema en la elección adecuada que no es fácil (actualmente se viene instalando microprocesadores ITALMEC PCT) (5); para ello se debe considerar

° **Volumen de la autoclave**. Estos volúmenes vienen a ser los volúmenes de trabajo; como las máquinas tienen formas complejas es mas práctico medir el volumen con una cierta cantidad de agua aforada previamente.

° **Calores específicos de los baños de teñido**. Normalmente este dato se encuentra en manuales (2) es decir se considera los datos para una determinada cantidad de sal disuelta, puesto que los otros productos están en cantidades mínimas y no son representativas.

° **Area de transferencia de calor de los serpentines existentes.** Conociendo el diámetro de la tubería y con un cálculo simple se puede determinar el área de transferencia que normalmente es de una tubería de acero inoxidable 316 célula 10.

° **Tiempo mínimo para llegar a una temperatura determinada.** En la practica es posible determinar el tiempo mínimo que se necesita para llegar a una temperatura, esto es muy importante y sirve para relacionar las válvulas de vapor y el programa, se considera un cierto margen de tolerancia.

° **Disposición de las fuentes de Vapor, Aire comprimido, agua blanda.** Es fundamental tener datos sobre la presión de trabajo de las calderas y sobre los volúmenes de vapor necesario para cada maquina. Las presiones de aire que se dispone y la cantidad en litros/hora. El consumo de agua blanda se calcula en base a promedios , así lo usual en bobinas cruzadas es de 100 litros por kilo de algodón procesado.

- **EFECTOS ESPECIALES AL HILADO:** En el mercado cada vez se encuentran nuevos e innovadores efectos en los hilos teñidos. Los caspeados y melange son un ejemplo de estos nuevos diseños; y para resolverlos se forma un grupo de trabajo conformados por técnicos. Un caspeado es un hilo que presenta uno o varios colores y partes sin teñir, normalmente estos efectos guardan cierta regularidad. El caspeado se puede lograr en la hilandería mezclando diferentes colores de fibra que puede ser de un mismo tipo o diferentes tipos de fibra, definitivamente si es 100 % algodón será la mas apreciada. En tintorería lograr un caspeado es teñir parcialmente el hilado y esto ocurre solo cuando el hilo esta compuesto por mas de una fibra y estas fibras tengan afinidad por diferentes colorantes como pueden ser algodón y poliester (polycotton) de acuerdo a la conveniencia se teñirá el algodón o el poliester. Los efectos melange es un caso particular de los caspeados cuyo componente es el negro. Los hilos policolores y los hilos teñidos y no teñidos, no se han resuelto en teñidos en autoclave tenemos información que estos efectos se logran estampando.

Existe gran interés en teñir con indigo en las autoclaves para ello se pidió asesoría a firmas conocidas como BASF y Zeneca aún no se llega a un termino feliz.

2.10.- PROCESOS SECUENCIALES CORRESPONDIENTE AL TEÑIDO DE ALGODÓN EN BOBINAS CRUZADAS:

En lo que corresponde a la técnica al TEÑIDO DEL ALGODÓN EN BOBINAS CRUZADAS es necesario exponer, aunque muy sucintamente los diferentes procesos secuenciales :

-**SOBRE EL INICIO DEL PROCESO** .- El teñido NO se inicia con la orden de producción remitida por la Gerencia sino que anteriormente existe un desarrollo de muestras a nivel de laboratorio (ver Apéndice FIG. 3) donde se logran reproducir los colores que necesariamente tiene que ser la aprobados por el cliente. El cliente normalmente viene a ser una Cia. de Confección que a su vez responde a un programa de producción de una Casa de modas o a Grandes almacenes, que normalmente se encuentran en el extranjero. Definido el color es importante la aclaración sobre las solideces que debe tener el color y el destino del hilo teñido, tejido de punto o tejido plano.

-**PREPARACIÓN** .- Teñir en bobinas cruzadas significa teñir el hilo bobinado en conos; la recepción del hilado se realiza en conos o quesos. Preparar significa pasar este hilado, por medio de coneras (ver Apéndice FIG. 4), a conos perforados bajo cierta dureza y tamaño que son fundamentales para el teñido.

-**BOLEADO** .- Es el proceso por el cual se elimina las partes menos irrigables de las bobinas

-**TEÑIDO**.- Es el proceso medular donde se va colorear el algodón por acción de los colorantes, se lleva acabo en una máquina denominado autoclave (ver Apéndice FIG. 5) . Existen varias clases de colorantes y los mas usados son los colorantes reactivos, ver Anexo 15, directos y tinas. Cada tipo de colorante tiene su proceso y su forma de teñir obedeciendo a parámetros de los fabricantes ;pero la curva(6) de teñido definitiva es la que tiene que ser diseñada por el jefe de Tintorería, así se plantean una infinidad de curvas que también esta limitada por el diseño de la máquina. Los colorantes Reactivos se tiñen en un medio alcalino, la mayoría de los Directos se tiñen en un medio neutro y los colorantes tinas se trabajan en un medio reductivo-alcalino.

El Teñido contempla tres subprocesos : preparación del hilado, teñido en si y acabado. En la preparación se limpia el hilado y se le da un alto grado de hidrofilidad indispensable para el teñido; puede ser un jabonado, descrude o preblanqueo. El teñido propiamente dicho es dar coloración al algodón por medio de sustancias que en su molécula contienen un grupo cromófero. En el acabado se le da la suavidad, la propiedad necesaria para que el hilo pueda ser usada, es decir el hilo pueda tejer sin problemas.

-**EXPRIMIDO.-** Es la eliminación de baño adherida al hilado, esto se realiza con la finalidad de secar mas fácilmente el hilo teñido (ver Apéndice FIG. 6).

-**SECADO.-** Como indica el nombre consiste en secar las bobinas; el método tradicional es con aire caliente que es impulsado por un compresor de tornillo, atraves de las bobinas (ver Apéndice FIG.7). Ultimamente se ha incrementado el uso de radio frecuencia con mejores resultados en cuanto al acabado de blancos y color (ver Apéndice FIG. 8). La conveniencia económica es discutible.

-**REBOBINADO.-** Es el paso del hilado teñido de los conos perforados a conos de cartón por medio de coneras (ver Apéndice FIG. 9) .

-**LIMPIEZA Y EMBALAJE.-** Es la eliminación de pelusas o polvos extraños al hilado por medio de aire comprimido y escobillas de cerdas (ver Apéndice FIG.10).

2.11.-CONTROL DE CALIDAD:

El Control de Calidad es importante en toda actividad productiva y en lo que refiere al teñido en bobinas cruzadas es aún mas determinante; los controles se realizan de tres maneras:

- CONTROL DE PROCESO.
- CONTROL DE MATERIAS PRIMAS.
- CONTROL DE HILO TEÑIDO.

- CONTROL DE PROCESO:

En todos los procesos existe un CONTROL DE CALIDAD permanente; en la preparación de las bobinas es imprescindible la dureza del embobinado, considerándose un factor importante para un buen teñido, así mismo en el boleado se verificará que la eliminación de zonas no irrigables sea total. En el teñido el control de los tiempos, la temperatura , pesos de colorantes y auxiliares es totalmente imprescindible. De una vez teñido el hilado el control del COLOR (Ver Apéndice 11) es lo mas importante y lo mas visible. En el secado es importante el control de la humedad residual pues un sobre secado origina en los blancos un amarillamiento y en los colores un resecado del hilado. En el rebobinado es importante el control de la parafina y la dureza del cono, así como el cruce del hilo debe ser uniforme. El embalaje y apilamiento se debe realizar teniendo en cuenta que los algodones son muy susceptible a la temperatura y el color no debe ser expuesto directamente al sol.

El control de calidad en proceso se puede sintetizar en:

- Dureza del cono: la densidad debe oscilar entre 320 gr/lt y 340 gr/lt.
- Boleado perfecto.

- Temperatura, tiempos, pesos, pH.
- Color , con factor de tolerancia máximo de 1.00

- CONTROL DE CALIDAD DE MATERIAS PRIMAS:

La materia prima principal viene a ser el hilo y a su llegada al almacén de hilo crudo es cuando se realiza los siguientes controles: Regularidad , Resistencia , Titulo, y en retorcidos torsión. Todo esto con la finalidad de evitar posteriormente un reclamo por los clientes, puesto que el teñido hace que el hilo pierda un diez por ciento de su resistencia, esto es normal (Ver Apéndice 12)

La regularidad se aprecia en pizarras o para casos mas precisos en USTER.

La Resistencia se mide en RKM, y los valores no deben ser menores a:

Ne	RKM mínimo *
20	13.0
24	13.0
30	12.8
40	12.8
50	12.8

Donde Ne viene a ser el título del hilo. * boneteria.

La Resistencia se mide en un aparato denominado Tensiometro, y puede ser tomado hilo por hilo o por madejas.

- CONTROL DE CALIDAD DEL HILO TEÑIDO:

Estos controles vienen a ser muy importantes, pues aseguran y garantizan el uso del hilado teñido, dado que en la actualidad los diseños son muy exigentes llegándose a usar con mucha frecuencia contrastes como blancos y negros, blancos y rojos intensos, blancos y marinos, y combinaciones similares. Los controles que se realizan pasamos a describir:

° DETERMINACIÓN DEL pH DEL HILO TEÑIDO; se realiza de acuerdo a la norma de la American Association Textile Chemists and Colorists (AATCC) ver Anexo 1. "AATCC Test Method 81-1980 pH of the Water-Extract from Bleached Textiles. Y los valores de pH debe ser entre 6.0 y 8.0 para telas de color; entre 5.5 y 6.5 para blancos. Ver Anexo 14.

2.11.1.- SOLIDECES.- Las solideces del hilo teñido se determinan sobre hilo blanqueado, en conformidad con las recomendaciones de la International Organization of Standardization (ISO) o de la American Association Textile Chemists and Colorists (AATCC)

SOLIDEZ A LA LUZ.- Actualmente tiene gran vigencia que un teñido tenga buena solidez a la luz , y gracias a la buena calidad de colorantes se logra mantener el color y cumplir satisfactoriamente esta prueba; para esta evaluación se ha elegido la **norma ISO 105/B02 luz de xenón** (Ver Anexo 2) y el valor mínimo permitido es de 3.5 para un tiempo promedio de 20 horas. En el País existen pocas empresas que poseen la lampara adecuada para llevar acabo esta prueba entre ellos tenemos Textil San Cristóbal y Textil Universal; la primera presta un servicio de control a terceros.

La norma descrita es la más exigente, pero hay clientes que prefieren la prueba de **Solidez a la luz de lámpara de arco AATCC método de ensayo 16 A** (ver Anexo 3).

Para las tintorerias que no poseen los equipos necesarios para las pruebas de solidez a la luz , no es mayor problema puesto que los proveedores de colorantes facilitan los manuales de cada colorante a usarse y en la que figura la solidez no solamente a la luz sino al lanvado, sudor, mercerizado, agua clorada, etc. pero es muy importante la norma aplicada para estas evaluaciones (ver Anexo 4). Existe una prueba muy práctica que delata la solidez que tiene un colorante, aunque no esta normado, y es la exposición que se realiza por 20 horas en forma perpendicular a los rayos del sol entre las 10:00 am y las 2:00 pm, (en invierno será imposible realizar esta prueba) normalmente esta prueba es comparativa con un colorante similar de solidez conocida.

SOLIDEZ AL LAVADO.- Si un teñido paso la prueba de solidez a la luz garantizando que no se decolorara prematuramente ante la exposición ala luz , es necesario realizar una prueba que nos de la tranquilidad de que una prenda compuesta por listados intensos junto a listados claros (blancos o crudos) no manche a estos últimos o simplemente no pierda el color ante una lavada. Estas pruebas toman el nombre de solidez al lavado y están normados y dentro de lo que mas se usa tenemos:

Lavado doméstico e industrial:
Lavado doméstico ISO 105/C06 C2S, 60°C (ver Anexo 5).

Solidez al lavado AATCC: lavado AATCC 61, 2 A 49°C (ver Anexo 6).

Sin embargo las normas son rigidas y requieren equipos que normalmente no esta al alcance de los tintoreros, entonces se realiza pruebas que este a la severidad de estos: así una prueba de solidez al lavado muy usado en nuestro medio es la que se denomina la "prueba de la corbata" que consiste en hacer una trenza con dos partes de hilo de color y una parte de hilo blanqueado sin óptico, se lava por 10 minutos a 60°C con 5 gpl de un detergente fuerte que normalmente es ariel, en una relación de baño de 1/50; se enfría a 35°C luego se vuelve a calentar a 60°C y así por tres veces.
La calificación en todos los casos de solidez al lavado se realiza sobre el testigo si el manchado es menor de 4 (escala de grises) el teñido es descalificado y con seguridad que se tendrá problemas de sangrado. Normalmente todos los colorantes reactivos pasan esta prueba salvo que hayan sido mal teñidos o mal jabonados.

La solidez a la luz y al lavado son los requisitos que se exige en la actualidad a todo teñido, sin embargo hay teñidos que por uso es necesario otras pruebas como:

Solidez al sudor: sudor ISO 105/E04 Alcalino y Acido. (ver Anexo 7).

Solidez al sudor: sudor AATCC 15 (ver Anexo 8).

Solidez al agua clorada: agua clorada de las piscinas ISO 105/E03.(ver Anexo 9).

Solidez al mercerizado: mercerizado ISO 105/X04 (ver Anexo 10).

Solidez al frote seco y humedo: AATCC Test Method 8-1977
Colorfastness to Crocking: AATCC Crockmeter Method (ver Anexo 11).

Solidez al planchado: Hot Pressing AATCC Test Method 133-1979 (ver Anexo 12).

2.12.- PROBLEMAS MAS FRECUENTES EN EL TEÑIDO DE HILADO EN BOBINAS CRUZADAS:

La tintoreria viene a ser el centro de atención de todas las actividades realizadas, antes de tener una prenda confeccionada, y cualquier problema se la relaciona; a pesar que muchos de estos se originan en otros puntos del proceso productivo la experiencia y la habilidad del tintorero permitirá en su oportunidad deslindar responsabilidades.

Dentro de los problemas mas frecuentes tenemos:

- Mala Igualación de la bobina teñida.
- Reproducción del color de laboratorio en planta.
- Partes no teñidas.
- Presencia de costras o cristales que no permiten el teñido.
- Mezcla de títulos en una sola partida.
- Mezcla de diferentes tipos de algodón en una misma partida.
- Error en el pesado de colorantes.
- Amarillamiento en el blanqueo.

- Hilo teñido que no teje.
- Presencia de fibra inmadura en el algodón.
- veteaduras en el tejido.
- Presencia de hilo débil.
- Pesos diferentes a las capacidades estándares de las autoclaves.
- otros problemas.

MALA IGUALACION DE LA BOBINA TEÑIDA:

La no igualación de la bobina teñida, es un problema que se presenta en todas las tintorerías de teñido de bobinas cruzadas, y se determina comparando el color de la parte externa con la parte intermedia y la parte interna; esto puede deberse a la mala elección de colorantes que se puede solucionar eligiendo colorantes adecuados, pero en la mayoria de los casos se debe a la mala distribución de flujos en el teñido, es decir en el teñido de bobinas cruzadas el teñido se realiza por flujos que van de adentro afuera y de afuera adentro ver Apéndice 2, lo cual se puede manejar a criterio del tintorero dándose tiempos adecuados en cada caso; por ejemplo para el teñido de colorantes reactivos es de 5 minutos de adentro afuera y 7 minutos de afuera adentro, con estos tiempos se obtienen buenos resultados pero esto también es función al tipo de máquina, presiones que desarrolla la bomba, tamaño de las bobinas, tipo de colorante usado. Etc.

REPRODUCCION DEL COLOR DE LABORATORIO EN PLANTA:

Las receta que se sirven para la producción en planta han sido desarrollados inicialmente en laboratorio a escala el "chiquito" teniéndose en cuenta todas las variables principalmente la relación de baño y las curvas temperatura Vs. Tiempo; no obstante a ello la reproducción en planta en algunos casos no es aceptable. Por la experiencia se puede afirmar que hay colorantes que se reproducen bien y hay colorantes que no tienen buena reproducción para lo cual el tintorero ya conoce el comportamiento de dichos colorantes. Una de las formas de solucionar estos problemas es trabajar con productos de buena pureza y nos referimos específicamente a la sal, que se usa para agotar al colorante, usar sal refinada (NaCl) normalmente conlleva a estos problemas por el contenido de calcio y magnesio que tiene como impurezas, si se usa sulfato de sodio de buena calidad (98%) la reproducción es muy buena, sin embargo esto significa encarecer mas el costo del teñido; en Cotton Designs se una sal 30/80 de Quimica del Pacifico que es una sal con un promedio de 24° alemanes de dureza para una disolución de 80gpl.

PARTES NO TEÑIDAS:

Este problema se presenta principalmente en algodones de poca afinidad tintorea como es el pima, algodones americanos, argentinos, etc. pero se debe a varios factores como: mala preparación del hilado antes del teñido, en estos casos se debe reforzar el baño con mayor cantidad de álcali, dar mas tiempo de tratamiento y usar un adecuado humectante, También se debe a la mala preparación de bobinas con posibles partes muy duras donde el flujo del baño de teñido tenga dificultad de ingreso, o la presencia de precipitados principalmente de sales alcalino terreos.

PRESENCIA DE COSTRAS O CRISTALES QUE NO PERMITAN EL TEÑIDO:

Efectivamente los algodones acarrean sin notar suciedad, tierra, abono, y su componente natural de grasas, peptina, lignina y pigmentos naturales; por otro lado la adición de sales agotadores contribuyen a cargar de impurezas los baños de teñido. Bajo estas condiciones y en un medio de pH alcalino es cuando se da la precipitación de carbonato de calcio e hidróxido de magnesio que son insolubles, a pesar de usar compuestos secuestrantes no se logra impedir estas precipitaciones que se fijaran en el hilado y por ende el teñido en ese punto es imposible quedando partes blancas. Esto se soluciona realizando una preparación adecuada del algodón y si es preferible usando sulfato de sodio de alta pureza.

MEZCLA DE TITULOS EN UNA SOLA PARTIDA:

La mezcla de títulos en una sola partida es un problema no frecuente pero se presenta, esto ocurre normalmente en la hilandería de donde proviene el hilado, o en el almacén de hilo crudo, es difícil detectar a tiempo y normalmente se ve el problema en la tejedura cuando en el tejido se presenta una raya. Sin embargo una inspección permanente en los diferentes procesos y acudiendo a la experiencia de los operarios se logra separar estos hilos, los coneros como todó el personal que manipula el hilo ayuda en esta tarea, para lo cual se debe instruir y el personal siempre estará en alerta.

MEZCLA DE DIFERENTES TIPOS DE ALGODON EN UNA MISMA PARTIDA:

Como se afirmo anteriormente no todos los algodones tienen la misma afinidad tintorea, así el tanguis tiene mas afinidad que el pima, algodón americano, argentino, ruso, boliviano etc. cuando la cosecha de algodón se ve afectado por fenómenos naturales o políticas agrarias es cuando se nota la presencia de estos algodones que definitivamente son de menor calidad y su presencia en partidas de teñido causa barreduras en el tejido. Esto normalmente es un problema de manipuleo que en la mayoría de los casos la tintorería no tiene participación. No obstante la inspección de calidad que se realiza antes del envalaje logra separar estos conos evitándose perdidas posteriores en el tejido.

ERROR EN EL PESADO DE COLORANTES:

Es una falla que no se presenta con frecuencia, pero es necesario comentarlo debido a que si no se establece el sistema adecuado de pesaje si se da y viene a ser un problema grave trayendo consigo perdidas económicas fuertes a la empresa. El sistema que se debe establecer es con verificación es decir el pesado debe estar a cargo de una persona pero tiene que ser verificada por otra persona en un punto anterior al teñido. Establecido este sistema el error por pesaje de colorante es casi nula.

AMARILLAMIENTO EN EL BLANQUEO:

En la actualidad se usan dos procesos para blanquear el algodón uno que es a base de agua oxigenada y un segundo a base de hipoclorito de sodio; el primero es el mas usado, pero en ambos casos se presenta casos de amarillamiento si es que no se lleva acabo correctamente el proceso. Esencialmente esto se debe a que no se logra neutralizar el algodón terminando con un pH superior a 8.5, este defecto normalmente solo se distingue cuando ya se tiene seca la partida. Otro factor que influye para que se de este defecto es el secado a temperaturas muy altas superiores a 110°C o secados muy prolongados; en el caso de bobinas cruzadas además de secar con aire caliente se puede secar con secadoras de radio frecuencia la cual se lleva acabo a temperaturas relativamente bajas +- 60°C, ver Apendice 8.

HILO TEÑIDO QUE NO TEJE :

En algunos casos el hilo esta bien teñido, aparentemente sin ningún problema pero llegado a la tejeduria (circulares) se nota que el hilo rompe antes llegar a las agujas o aparecen huecos en el tejido, lo que se llama que el "hilo pica" ; esto es originado por una de las siguientes razones: un mal parafinado que se realiza en el reenconado con una parafina no adecuada; o puede darse por un mal suavizado en la ultima etapa del teñido, en ambos casos se soluciona realizando nuevamente y adecuadamente los procesos. Existe la posibilidad que el hilo no teja también por precipitación de carbonato de calcio o hidróxido de magnesio en el hilo durante el teñido; de ser así se realiza un lavado ácido neutralizado y suavizado, para evitar estas precipitaciones se usa secuestrantes o acomplejantes de estos alcalinos térreos como son los derivados de los fosfatos, existen también productos orgánicos patentados muy usados en nuestro medio como son: el dekol sn (BASF), irgasol co Química Suiza), ladicuest (Hoechst) etc.

PRESENCIA DE FIBRA INMADURA EN EL ALGODON:

Ante la presencia de fibra inmadura en el algodón, en la tintorería se puede hacer muy poco, aunque en algunos casos se logra disimular este defecto. Esta fibra tiene su origen en el campo en la cosecha del algodón debido a que la cosecha se realiza a destiempo; se sabe que la fibra inmadura es la cristalización de la celulosa la cual la hace prácticamente repelente a casi todos los colorantes, sin embargo existen colorantes que llegan a cubrir estos cristales como son los colorantes directos o algunos colorantes tinas. Los colorantes reactivos que son los mas usados no cubren a la fibra inmadura. Todas maneras estos hilos originan tela de segunda.

VETEADURAS EN EL TEJIDO:

Los veteados en el tejido se dan por múltiples factores, entre los mas frecuentes tenemos:

- Presencia de residuos de aceite de los telares o circulares en la tela.
- Mezcla de partidas teñidas.
- Mezcla de títulos dentro de una partida.
- Mala igualación de las bobinas teñidas.
- Mezcla de diferentes tipos de algodón en una misma partida.

PRESENCIA DE HILO DEBIL:

La presencia de hilo débil se debe a dos factores, primero el hilo puede nacer débil desde la hilandería; segundo se puede originar un hilo débil en la tintorería debido a un proceso muy drástico llevado acabo, es necesario indicar que todo proceso debilita al hilo y si se lleva acabo entre un pH de 4.00 a 9.00 el debilitamiento es aún mayor. Se considera normal una caída de 10 a 15 % de la resistencia (esto se expresa en RKM).

Verificado la existencia de hilo débil se puede mejorar esta resistencia tratándolo con productos que contengan poliacrilatos como es el caso del ukosoft 49 (comercializado por CPPQ);este producto recubrirá al hilo a manera de forro dándole una mayor resistencia, el inconveniente esta en que a la hora del tejido deja residuos producto de la fricción con esta capa recubridora.

PESOS DIFERENTES DE LAS CAPACIDADES ESTANDARES DE LAS AUTOCLAVES:

Todas las autoclaves tienen un peso de trabajo establecido por diseño, pero los fabricantes de estas máquinas proponen un peso variable creando una bolsa de aire y tratando de mantener constante la relación peso de trabajo y volumen de baño de teñido; lo cual no se logra exactamente, esta distorsión hace que varie la relación de baño lo cual afecta grandemente en la reproducción del color en planta. Por otro lado los clientes no logran acomodarse exactamente a los múltiplos de los pesos de trabajo de las máquinas este inconveniente actualmente se presenta a menudo debido a que los pedidos son mas cercanos a las necesidades tratándose que los márgenes sean cada ves mas cortos. Este inconveniente se logra superar realizando recetas en laboratorio que tengan la misma relación de baño que va tener en planta. Es necesario hacer notar que a mayor relación de baño el rendimiento de los colorantes baja considerablemente.

OTROS PROBLEMAS:

Existe otros problemas no frecuentes en la tintorería como son: diferencia apreciable entre lote y lote de un mismo colorante, error en la elaboración de recetas, fallas en la energía eléctrica, fallas eléctricas y o mecánicas en las autoclaves

2.13.- EVALUACION ECONOMICA:

El teñido en bobinas cruzadas, de hilado de algodón, es una actividad que se mantiene en buen lugar, dentro de la baja de volúmenes de producción de la industria textil; definitivamente todo comienza con la demanda de este género, y su aplicación mas conocida es el tejido de punto, en los diseños listados; aunque algunos se atreven a tejer prendas de color entero con hilo teñido, lo cual es un riesgo. En el tejido listado no tiene punto de comparación y es la mejor forma de obtener estos diseños.

Otro rubro donde se usa también es en la elaboración de chompas, en este caso debido al uso de hilo grueso también se tiñe en madejas.

Existe un mercado muy exigente, aunque de menor volumen de hilado teñido referido al tejido plano, principalmente destinado a camiseria; y todo lo que sea tela plana listada en sentido de trama y/o urdimbre.

El mercado para el hilo teñido, es muy interesante destinándose un 90 % a un 95 % a la exportación sin considerar blancos ópticos, el valor agregado, el encarecimiento de las prendas, hace que no se tenga un porcentaje mayor para el mercado local. Es necesario comentar que dentro del mercado nacional las calidades menos exigentes es lo mas difundido. Ver Anexo 16 y Anexo 17.

Existe en nuestro País empresas que se dedican exclusivamente al teñido de hilo, que definitivamente prestan servicios a confeccionistas; quienes organizan todo el ciclo productivo. Estas Empresas adquieren contratos de confección de prendas en Ferias internacionales o por contactos con Casas Importadoras de otros países, existen agentes que se dedican exclusivamente a esta actividad, que dan la buena pro a la mejor oferta. En la actualidad existe mucha competencia con los Países del oriente y el Brasil a pesar que no poseen algodón de la calidad del tanguis o pima y esto se debe a que en dichos países se han desarrollado procesos preliminares que hace que un algodón de baja calidad se pueda comportarse como un algodón de buena cualidad, además que son fabricantes de productos químicos auxiliares y colorantes que nosotros importamos, bajando considerablemente sus costos.

2.14.- CONCLUSIONES Y RESULTADOS:

° El funcionamiento de una Planta de teñido de bobinas cruzadas como todo centro productivo tiene bien enmarcados y claramente delineados sus diferentes secciones o departamentos.

° La Distribución de planta, debe ser siguiendo estrictamente el diagrama de flujo; para evitar transportes inútiles de los productos en procesos y lo dificultoso que significa manipular bobinas húmedas; además esto significa evitar tiempos muertos en la producción; por otro lado también significa un mejor aprovechamiento de los espacios.

° Es importante la relación estrecha que debe tener entre la Jefatura de la Tintorería, la Gerencia y el Departamento de ventas; por que es la Tintorería la que va afrontar los diferentes problemas principalmente los reclamos de los clientes que en la mayoría de los casos son problemas totalmente ajenos, como defectos de hilandería, tejeduria y acabado. Es importante una apreciación correcta del problema. Los problemas originados en la Tintorería deben ser resueltos con el mínimo costo posible.

° Consideramos que todas las actividades cumplidas por la Jefatura de la tintorería son importantes; pero hay una actividad, que no se menciono anteriormente es de igual importante la cual es de orientación antes del servicio y apoyo de pos venta a nuestros clientes. Esto consiste en explicar a los clientes las bondades de los diferentes tipos de teñido y cual seria lo mas recomendable para el uso que se dará al hilo teñido; el servicio de pos venta normalmente es de orientación para un optimo acabado.

° Es preciso señalar que la opinión del Jefe de Tintorería es importante para la toma de decisiones en cuanto a los planes de ampliación o equipamiento de la planta.

° Merece especial atención los costos de teñido, los reprocesos y fallas en el teñido ocasionan perdidas directas a la Empresa.

3.- RESUMEN

Lo que se ha pretendido en el presente informe, es mostrar de una manera simple el funcionamiento de una planta de teñido de bobinas cruzadas. Haciendo notar que esta actividad conlleva responsabilidades a todo nivel.

Los procesos a seguir son:

- Elaboración del Lab-dips en el Laboratorio, que debe ser aprobada por el cliente.
- Preparación de bobinas en conos o tubos perforados.
- Boleado.
- Teñido.
- Exprimido.
- Secado.
- Rebobinado.
- Limpieza y embalaje.

La Jefatura, es la encargada en organizar y hacer que estos procesos se lleven acabo eficientemente; impartiendo las directivas necesarias, seleccionando colorantes, distribuyendo el personal necesario, coordinando los mantenimientos de la planta y también informando a la Gerencia los avances del programa de producción y los requerimientos para llevar acabo los procesos (ordenes de compra etc.) Es también de su responsabilidad evaluar los nuevos productos, implementación de nuevos equipos y procesos, y todo lo que este relacionado con la producción.

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5.- APENDICE .

- Figura 1 Portamaterial Vacío.
- Figura 1A Portamaterial cargado y Teñido.
- Figura 1B Portamaterial de Fibra.
- Figura 2 Flujo In-Out.
- Figura 2 A Flujo Out-in.
- Figura 3 Operando el Data-Color.
- Figura 3 A Equipo de Teñido - Laboratorio.
- Figura 3 B Equipo de Teñido - Laboratorio.
- Figura 3C Caja de Luces.
- Figura 4 Coneras Preparando Bobinas.
- Figura 4 A Coneras Preparando Bobinas.
- Figura 5 Dos autoclaves.
- Figura 5 A Autoclave de 160 Kgr.
- Figura 5 B Autoclave de 330 Kgr.
- Figura 5C Autoclave y Secadora Alineados.
- Figura 5D Autoclave LONGCLOSE.
- Figura 5E Autoclave TONG GENG.
- Figura 6 Centrifuga.
- Figura 6 A Camino a la Secadora.
- Figura 7 Secadora: de Aire Caliente.
- Figura 7 A Compresor Tipo Tornillo-Secadora.
- Figura 8 Secadora de RF: FASTRAN.
- Figura 9 Reenconado de Bobinas.
- Figura 9 A Secuencia del Teñido.
- Figura 10 Hilo Teñido y Envalado.
- Figura 11 datacolor Para el Control del Color.
- Figura 12 Tensiometro: Mide la Resistencia del Hilo.

6.-ANEXOS

ANEXO 1 Determinacion del pH “ AATCC TEST METHOD 81-1980 pH of the Water-Extract from Bleached Textiles.

ANEXO 2 : Solidez a la luz Norma ISO 105/B02 luz de xenon B02 fastness to artificial light : Xenon arc fading lamp test.

ANEXO 3 : Solidez a la luz “Colorfastness to Light: Carbon - Arc Lamp, Continous Light.” AATCC Test Method 16 A - 1977.

ANEXO 4 : Información de Solideces de los colorantes, proporcionado por los fabricantes.

ANEXO 5 Solidez al lavado doméstico ISO 105/C06 C 2S, 60°C. “C06: Colour fastness to domestic and comercial laundering”

ANEXO 6 Solidez al lavado AATCC : Lavado AATCC 61 , 2 A 49°C. Colorfastness to Washing, Domestic; and Laundering, Commercial; Accelerated.

ANEXO 7 Solidez al Sudor ISO 105/E04 Alcalino y Acido. “ E04 : Colour Fastness to perspiration “

ANEXO 8 Solidez al sudor: sudor AATCC 15 “ Colorfastness to Perspiration - . AATCC Test Method 15-1979”.

ANEXO 9 Solidez al agua clorada: agua clorada de las piscinas ISO 105/E03. “ E03: Colour fastness to chlorinated water swimming - bath water “

ANEXO 10 : Solidez al mercerizado ISO 105/X04 “ X04: Colour fastness to mercerizing “.

ANEXO 11 Solidez al frote seco y húmedo : “Colorfastness to Crocking: AATCC Crockmeter Method AATCC test Method 8 - 1977 “.

ANEXO 12	Solidez al planchado : " Colorfastnes to Heat : Hot Pressing AATCC Test Method 133 - 1979 ".
ANEXO 13	Muestras de pruebas de solideces: a.- Al lavado domestico ISO/C06 C2S 60°C. b.- Al frote húmedo test Method 8-1977 AATCC. c.- Al frote seco test Method 8-1977 AATCC. d.- Al lavado "Prueba de la Corbata".
ANEXO 14	Especificaciones Técnicas: para prendas de punto Por: Knits - Fleece / French Terry Specification # 2005.
ANEXO 15	Grupos reactivos de los colorantes REACTIVOS.
ANEXO 16	Exportación de productos textiles.
ANEXO 17	Empresas Textiles Exportadoras.
ANEXO 18	Tipos de teñidos: Reactivos, Tina, Directos.
ANEXO 19	Fijación de Colorantes Reactivos.

FIG.1.- PORTAMATERIAL VACIO.

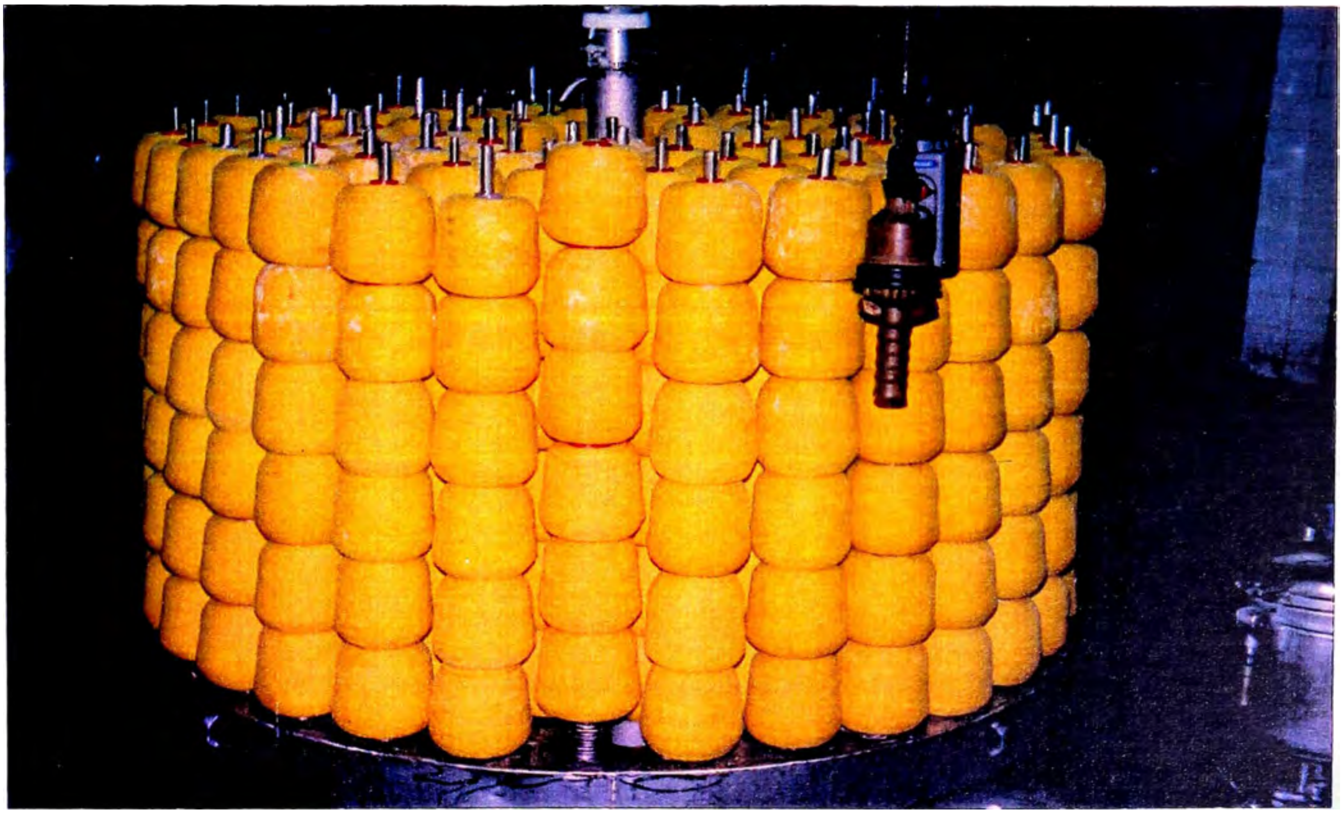


FIG.1A.- PORTAMATERIAL CARGADO Y TEÑIDO.

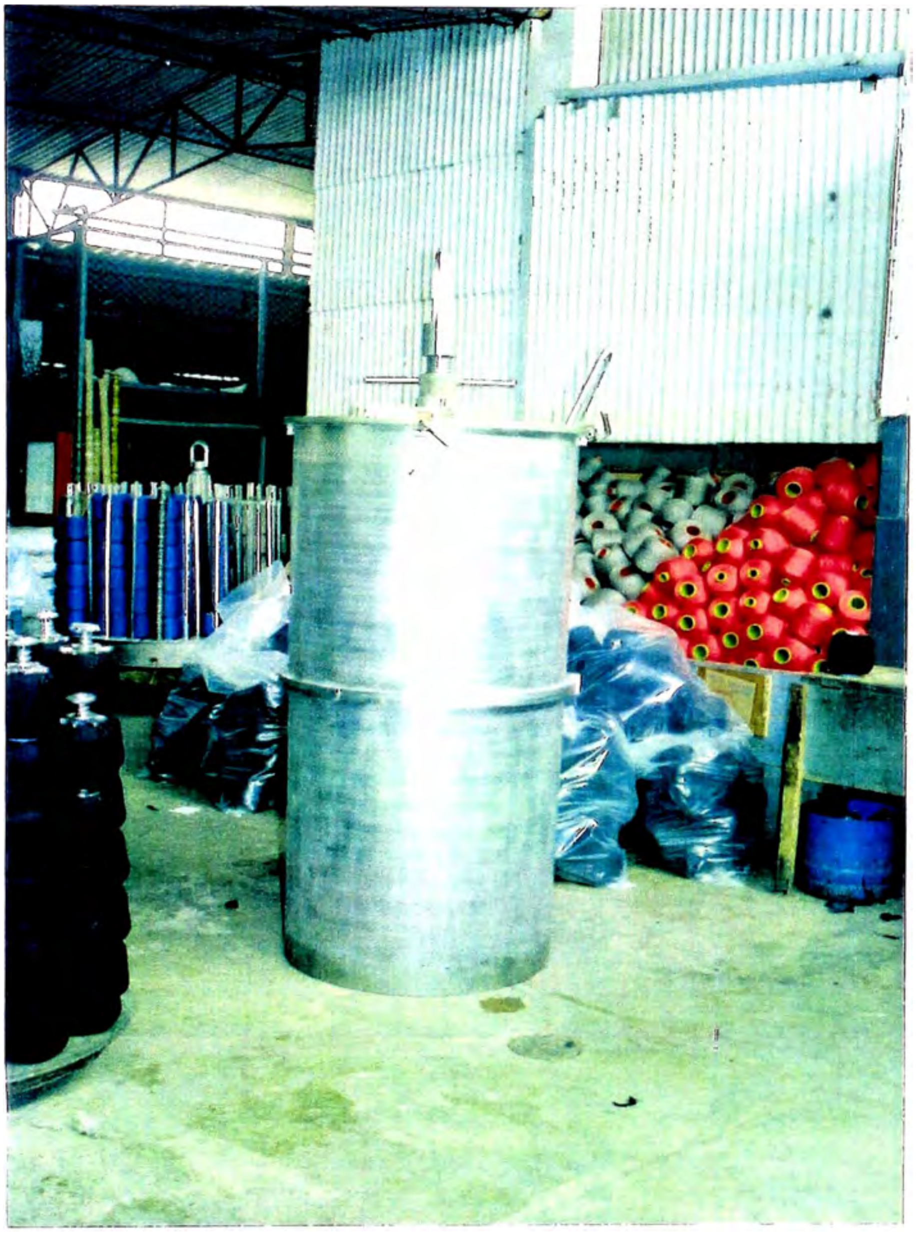


FIG. 1B.- PORTAMATERIAL DE FIBRA.

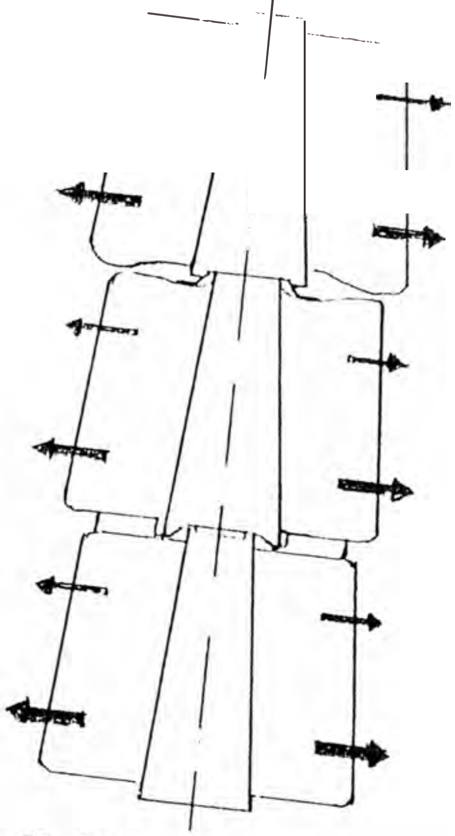


FIG.2.- FLUJO IN_OUT.

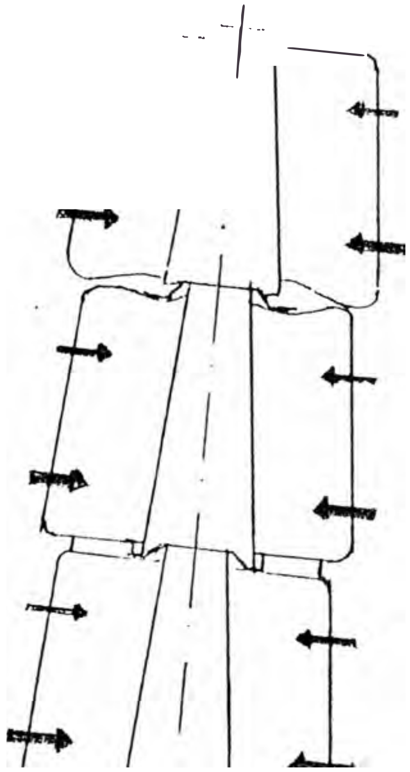


FIG.2A.- FLUJO OUT_IN.

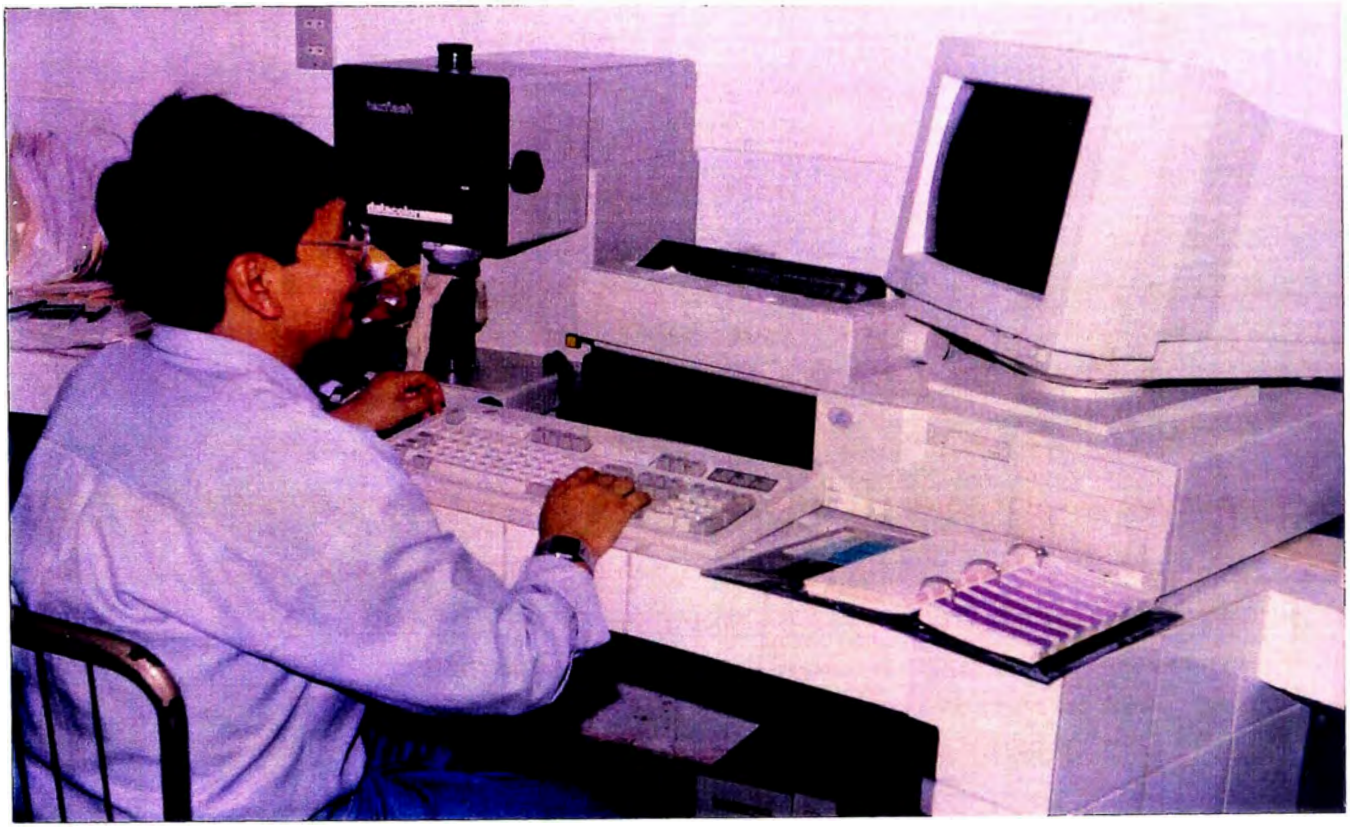


FIG.3.- OPERANDO EL "DATA_COLOR".

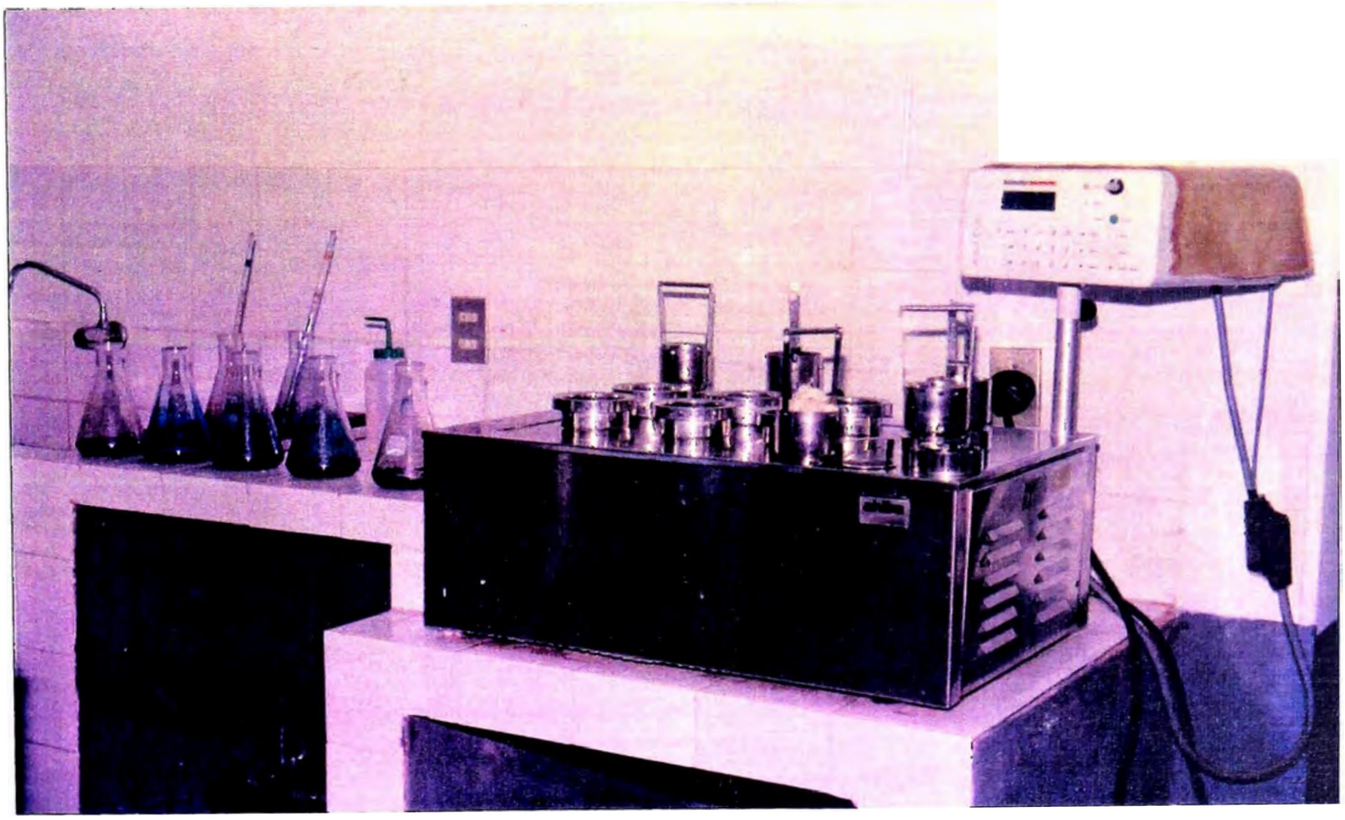


FIG.3A.- EQUIPO DE TEÑIDO - LABORATORIO.

FIG.3B.- EQUIPO DE TEÑIDO_LABORATORIO.

FIG.3C.- CAJA DE LUCES.

FIG.4.- CONERA PREPARANDO BOBINAS/

FIG.4A.- CONERA PREPARANDO BOBINAS.

FIG.5.- DOS AUTOCLAVES.

FIG.5A.- AUTOCLAVE DE 160 KGR.

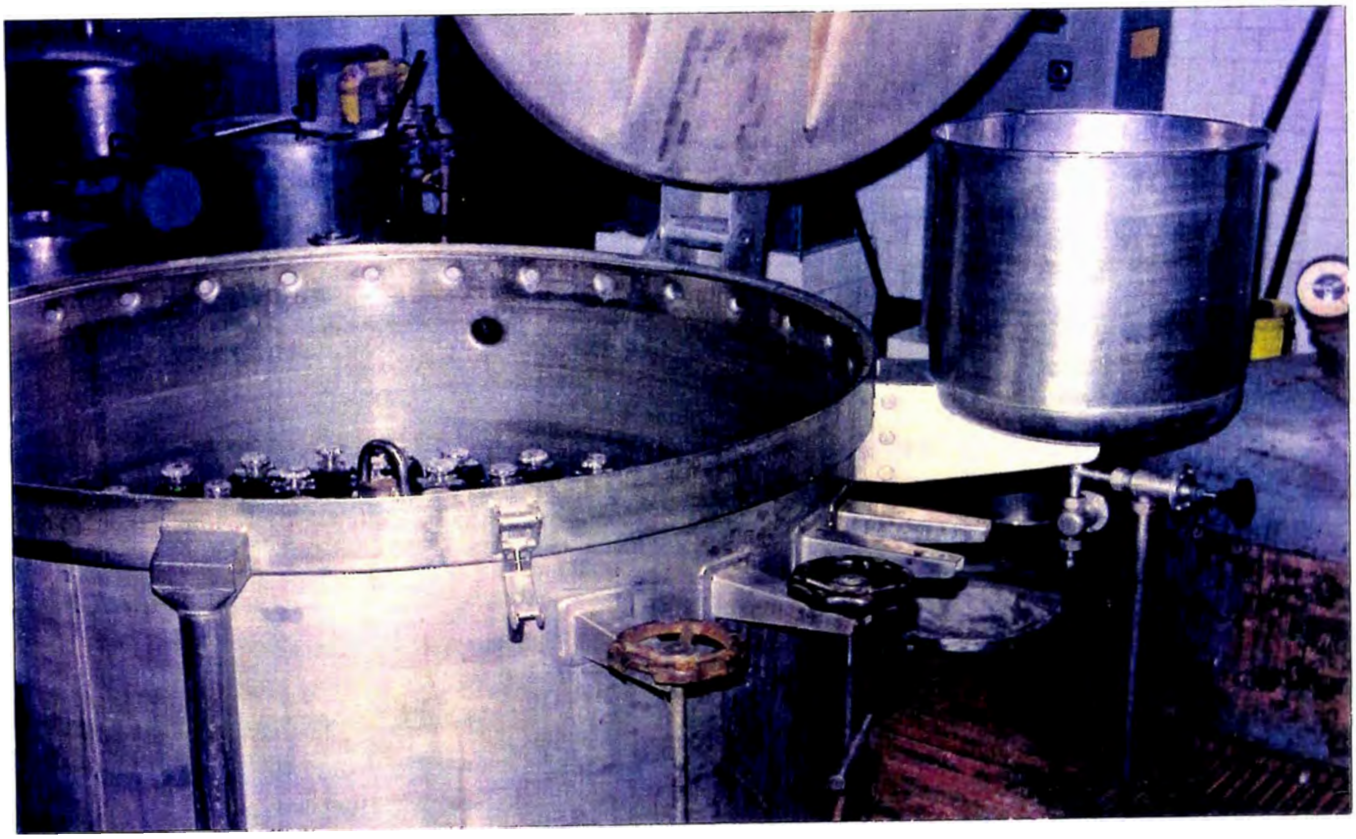


FIG.5B.- AUTOCLAVE DE 330 KGR.

FIG.-5C.- AUTOCLAVES Y SECADORA: ALINEADOS.

UNICON
DYEING MACHINES

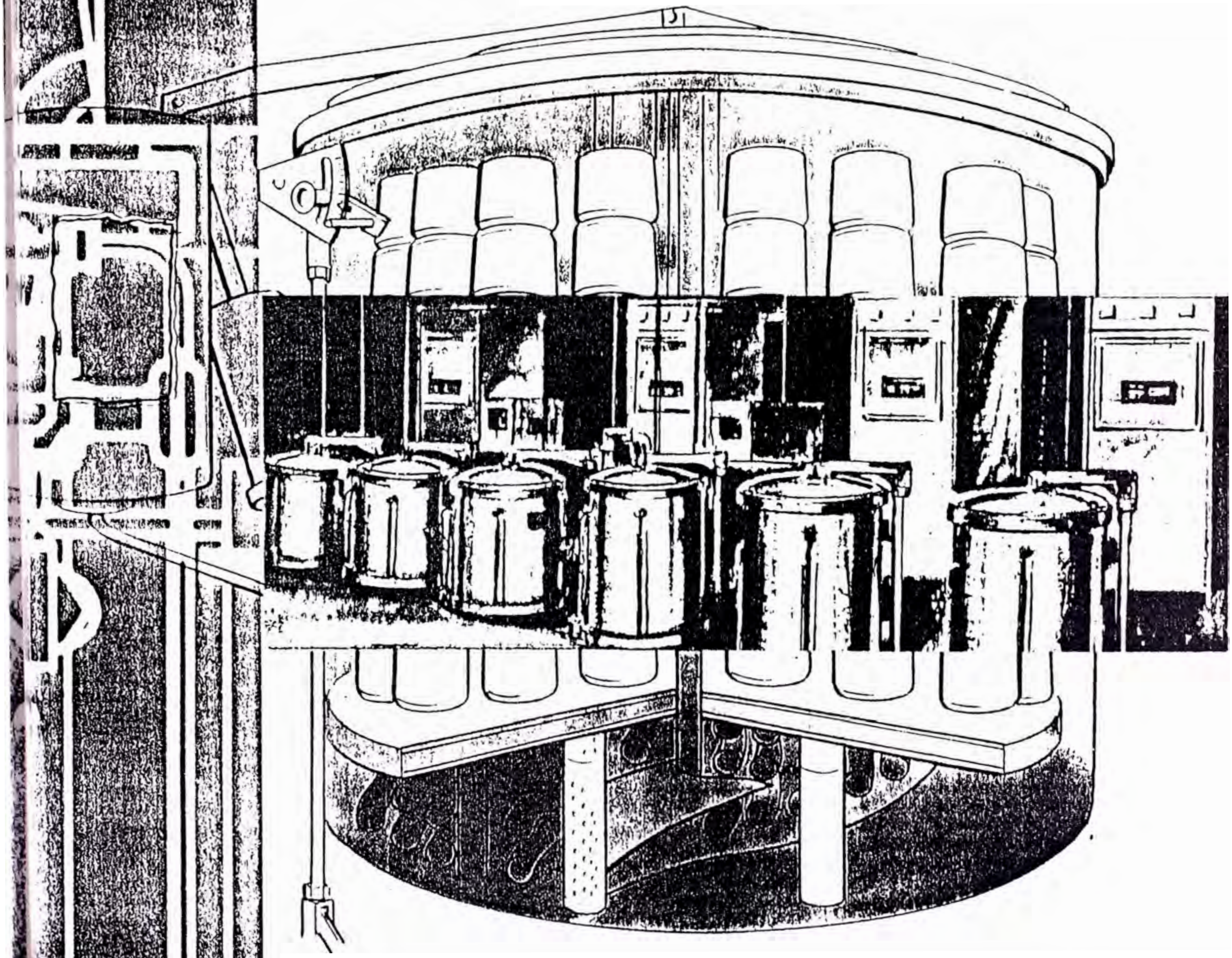


FIG. 5D.- AUTOCLAVE LONGCLOSE.

longclose LTD.

ADVANCED TECHNOLOGY DYEING MACHINERY

UNICON

The Longclose Unicon Bleaching and Dyeing System provides the ultimate in batch processing flexibility for yarns in package or hank form, warp beam, loose fibre, tops, tow, surgical gauze, hose and narrow fabrics.

The Unicon is produced in a comprehensive range of machine sizes with versions available for operation under atmospheric conditions or alternatively under pressurised conditions with temperatures of up to 140°C.

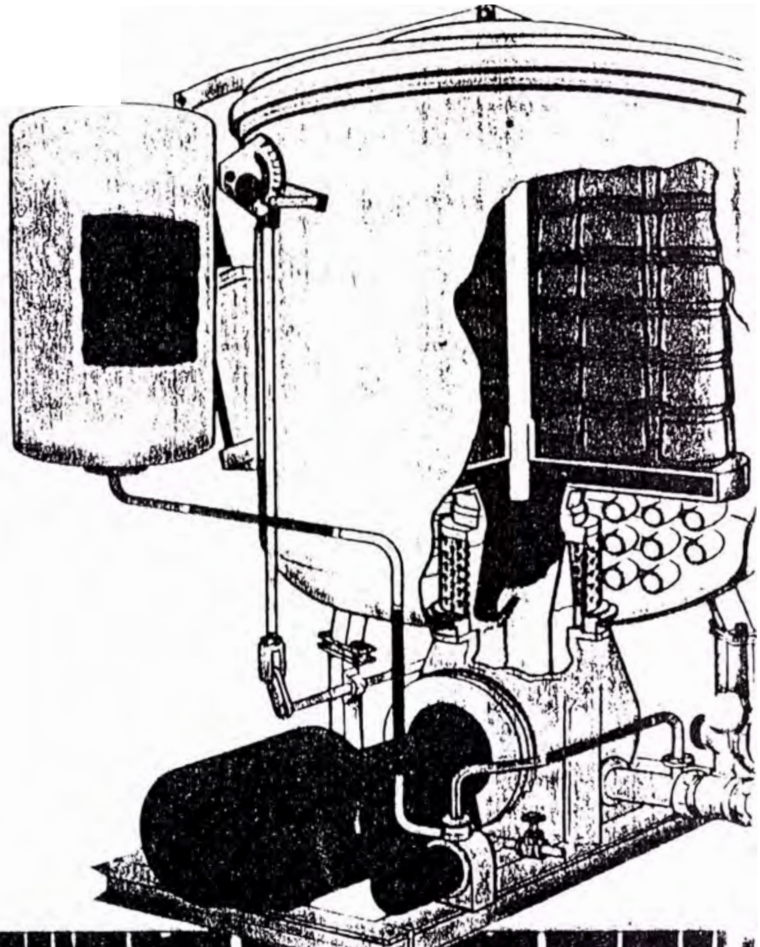
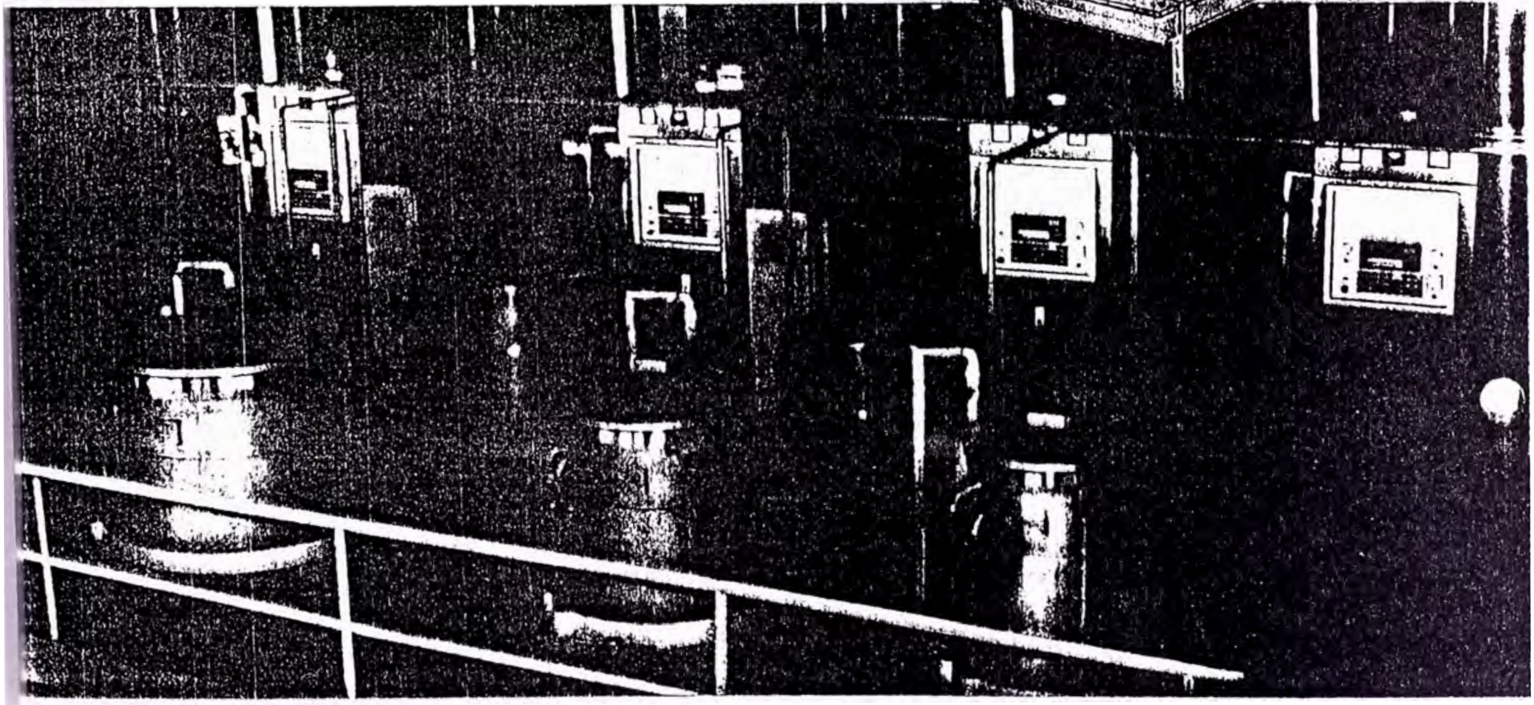
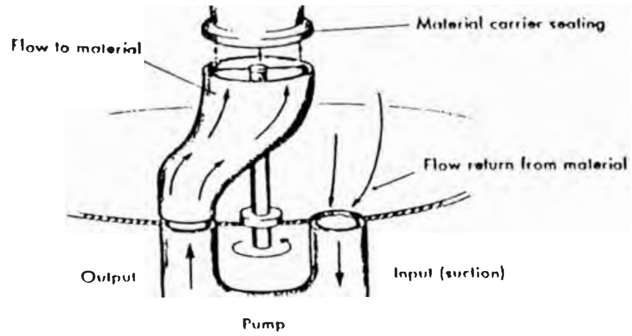


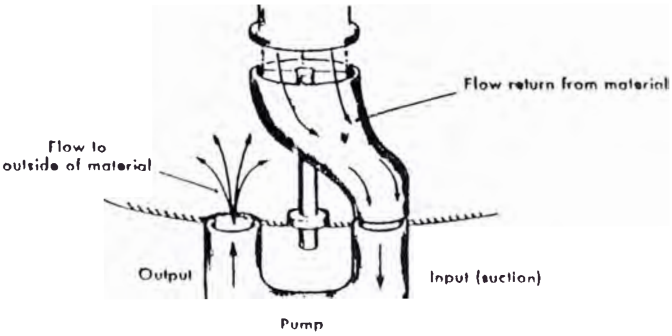
FIG. 5D.- AUTOCLAVE LONGCLOSE.



COURTESY OF SATIN TEXTILES CO LTD., THAILAND



In/Out Flow Position



Out/In Flow Position

MACHINE FEATURES AS SPECIFIED

HIGH EFFICIENCY PUMP UNIT
Directly coupled at the base of the kier eliminating interconnecting pipework and flow losses.
Identical flow across the full range of machine sizes.
Relatively slow running to enhance seal and bearing life.
Inverter pump speed control option.

PATENTED FLOW REVERSAL UNIT
Unique "swan-neck" design and flow diffuser ensures even flow to and from every part of the vessel without the use of complex valve systems.

HIGH EFFICIENCY HEAT EXCHANGER
Coil surrounds flow reversal device in base of kier providing rapid heating and cooling performance.

LOWEST POSSIBLE LIQUOR RATIOS
Maximum economy is achieved due to the combination of air pad pressurisation and pump/flow reversal/exchanger design.
Liquor ratios standard across the range of machine sizes.

FULL CAPACITY STOCK TANKS
Provide capabilities for the best use of dye and rinse liquors as well as offering cooling water/recycling facilities.

RAPID ADDITIONS SYSTEM
Via dedicated additions tank adjacent to machine.

RAPID FILL CAPABILITIES
Either hot, cold or blended.

RAPID DRAIN FEATURES
Reduce drain times to a minimum. Drain hot, cold or under high temperature and pressurised conditions.

ENHANCED WASH OFF
Is achieved by the use of a special overflow rinse device.

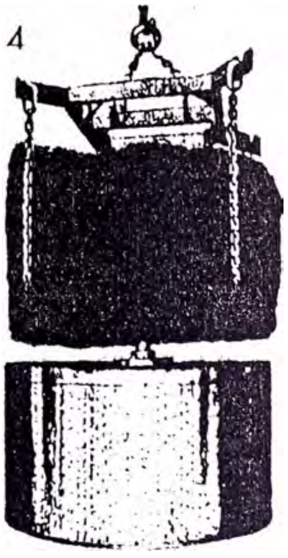
TOTAL DYECYCLE CONTROL
May be specified to include dosing, salt gulping, pH control, conductivity measurement, differential pressure and other process variables.

HI-LO MULTI-LEVEL FLEXIBLE LOAD SYSTEM
Enables reduced loads to be processed whilst maintaining a virtual constant liquor ratio.

COUPLED MACHINES
Extend the Unicons flexibility.

3

4



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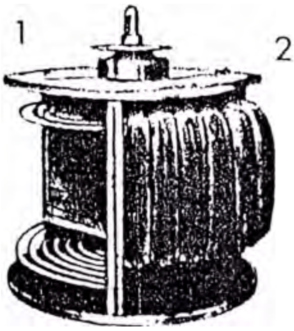

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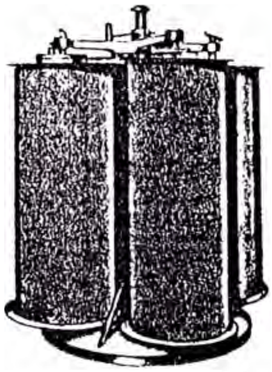

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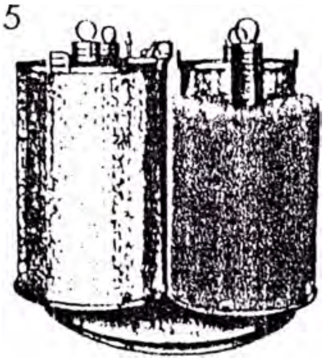

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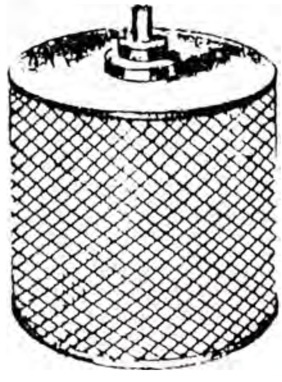


FIG. 5D.- AUTOCLAVE LONGCLOSE/

1 Hank
2 Warp Beam
3 Yarn on cone or press pack
4 Loose fibre, tow and hose
5 Bump/Ball tops
6 Surgical fibre and gauze

Machine Data	Nominal Capacity		Kier Diameter (d)	Nominal Liquor Volume	Approx overall floor area (machine and addition tank)	Approx. datum to tank rim (h)
	CONE	Press Pack				
A	10kg 22lb	n/a	424mm 16.7in	80 litre 17.6 gal	880 x 1030mm 35 x 41in	1320mm 52in
CD36	30kg 66lb	40kg 88lb	533mm 21in	240 litre 53 gal	1270 x 1450mm 50 x 57in	2464mm 97in
FD36	55kg 120lb	75kg 165lb	762mm 30in	440 litre 96 gal	1676 x 2135mm 66 x 84in	2575mm 101in
HD36	100kg 220lb	135kg 297lb	915mm 36in	800 litre 176 gal	1830 x 1980mm 72 x 78in	2575mm 101in
SD36	150kg 330lb	200kg 440lb	1066mm 42in	1200 litre 264 gal	1900 x 2000mm 75 x 79in	2645mm 104in
XD36	200kg 440lb	275kg 605lb	1295mm 51in	1600 litre 352 gal	2440 x 2440mm 96 x 96in	2645mm 104in
KD36	250kg 550lb	325kg 715lb	1371mm 54in	2000 litre 440 gal	2500 x 2500mm 98 x 98in	2645mm 104in
ID36	330kg 730lb	450kg 990lb	1676mm 66in	2640 litre 594 gal	2745 x 2745mm 108 x 108in	2820mm 111in
JD36	500kg 1100lb	700kg 1540lb	2000mm 78in	4000 litre 880 gal	3660 x 3660mm 144 x 144in	2970mm 117in
JD72	1000kg 2200lb	1400kg 3080lb	2000mm 78in	8000 litre 1760 gal	3660 x 3660mm 144 x 144in	3885mm 153in

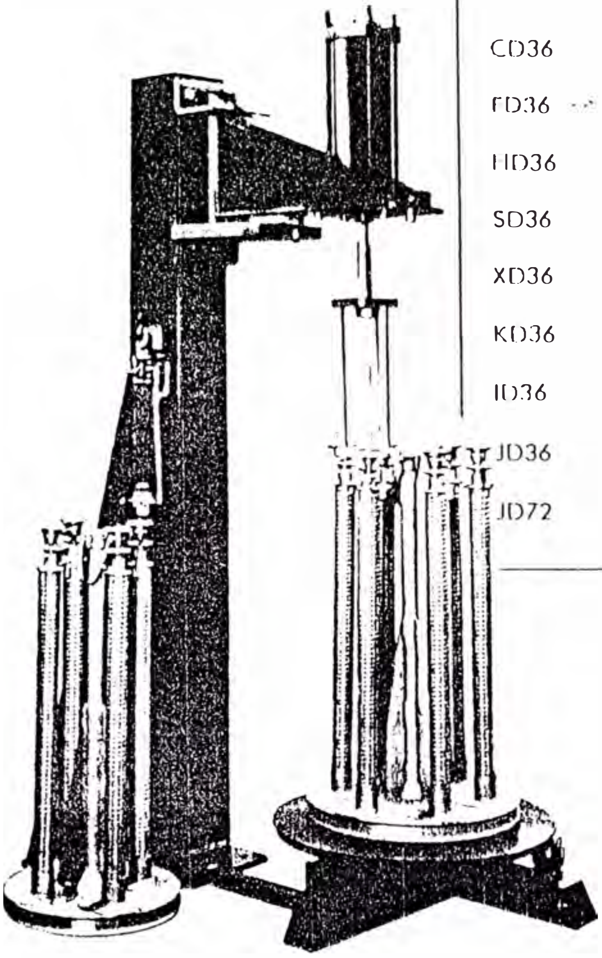
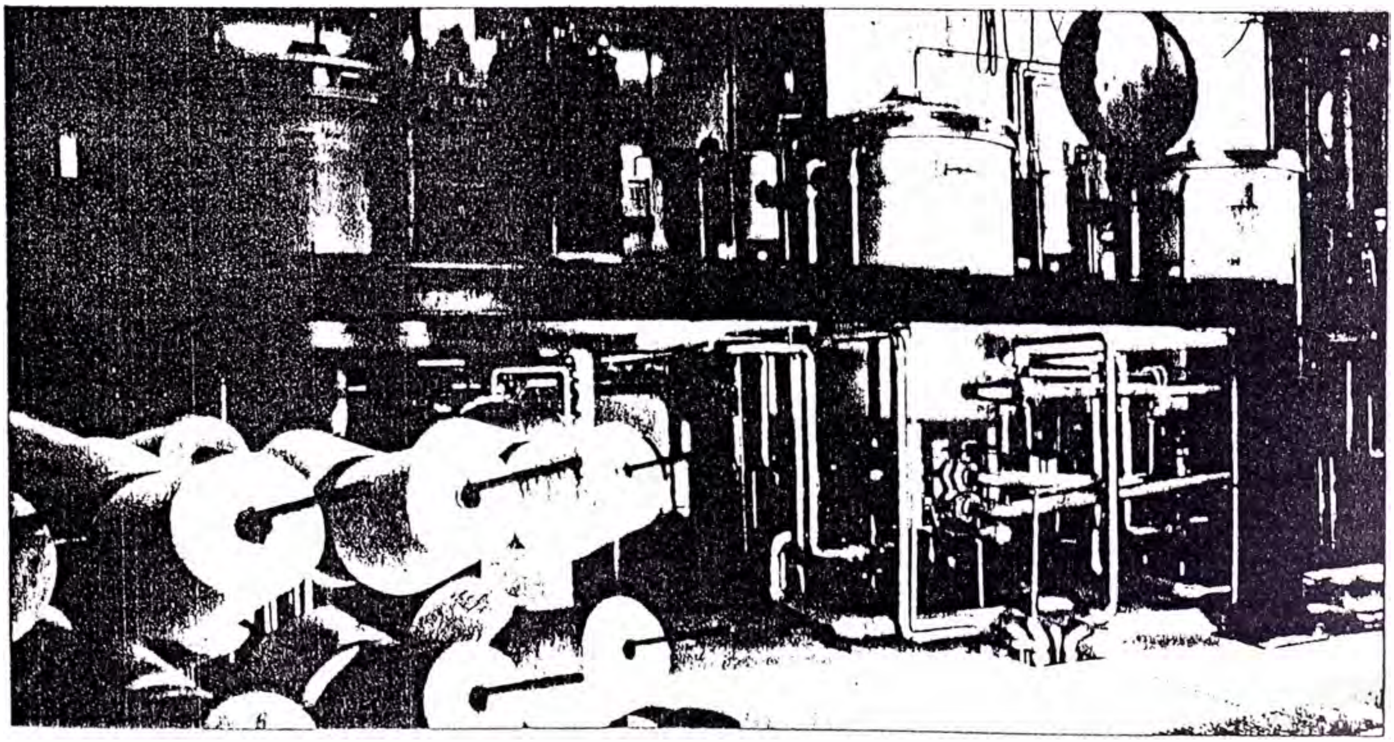


FIG. 5D.- AUTOCLAVE LONGCLOSE.



COURTESY OF TEKSMOBILI TEKSTIL SANAYI VE TICARET AS TURKEY

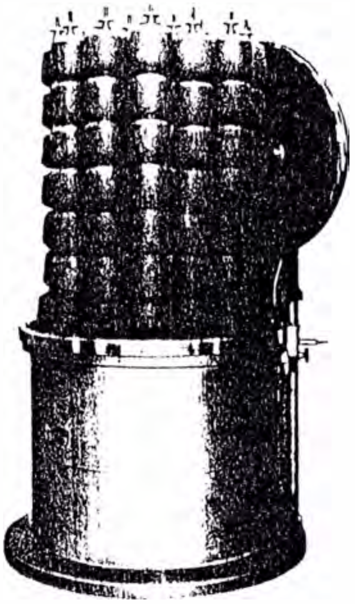
£ 52,000 B [illegible]

UNICON RAPID PACKAGE DRYER

Designed to complement the package dyeing machines in the modern dyehouse environment.

By accepting package carriers directly from the dyeing machine, without separate hydroextraction or manual handling, labour requirements are minimised and physical distortion of packages is prevented.

The totally enclosed drying system with low resistance high output blowers, improved moisture extraction devices and fully automatic controls produce rapid drying cycles with minimum energy consumption.



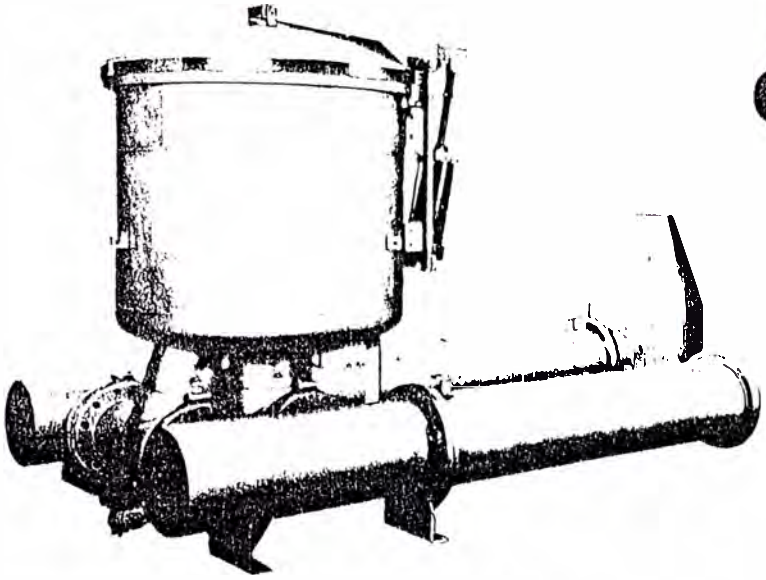
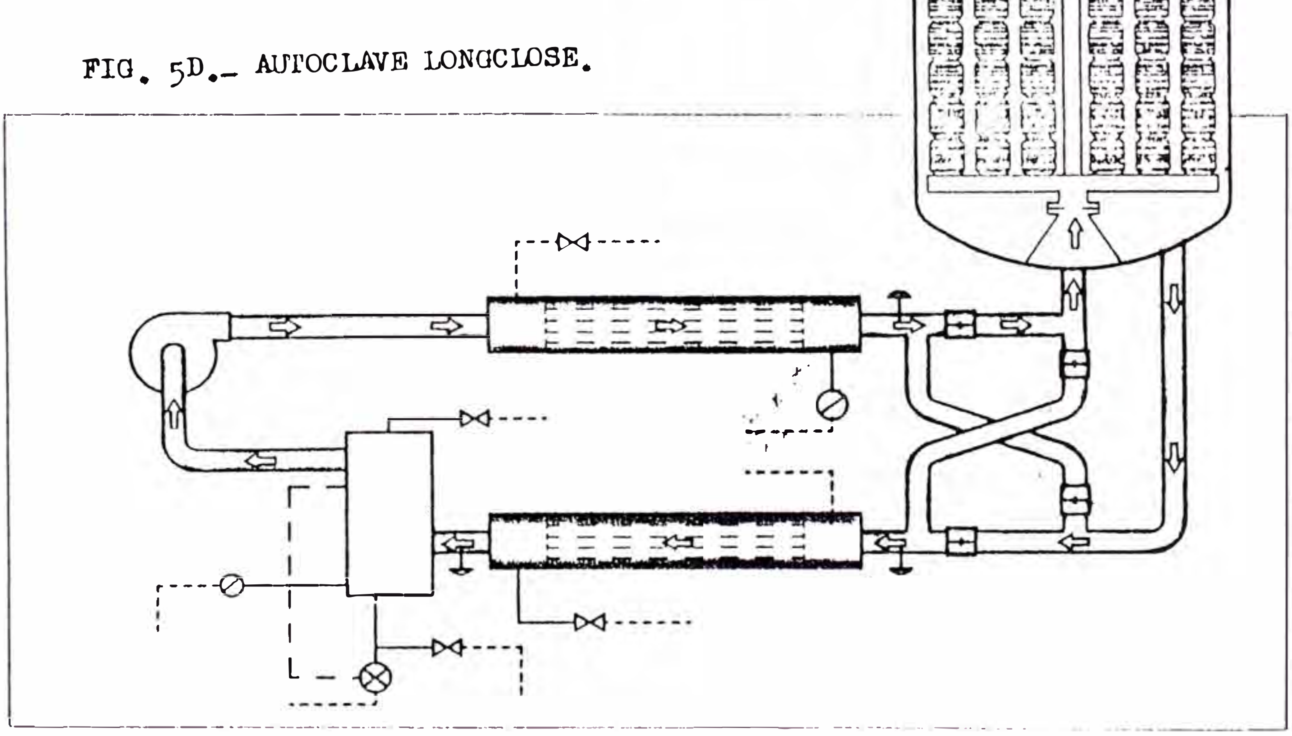


FIG. 5D.- AUTOCLAVE LONGCLOSE.



CONTROLS AND AUTOKITCHEN DISPENSARIES

CONTROLS

Microcomputer control panels provide a cost effective, high performance dyecycle control facility by applying modern computer technology to the Longclose range of dyeing machinery.

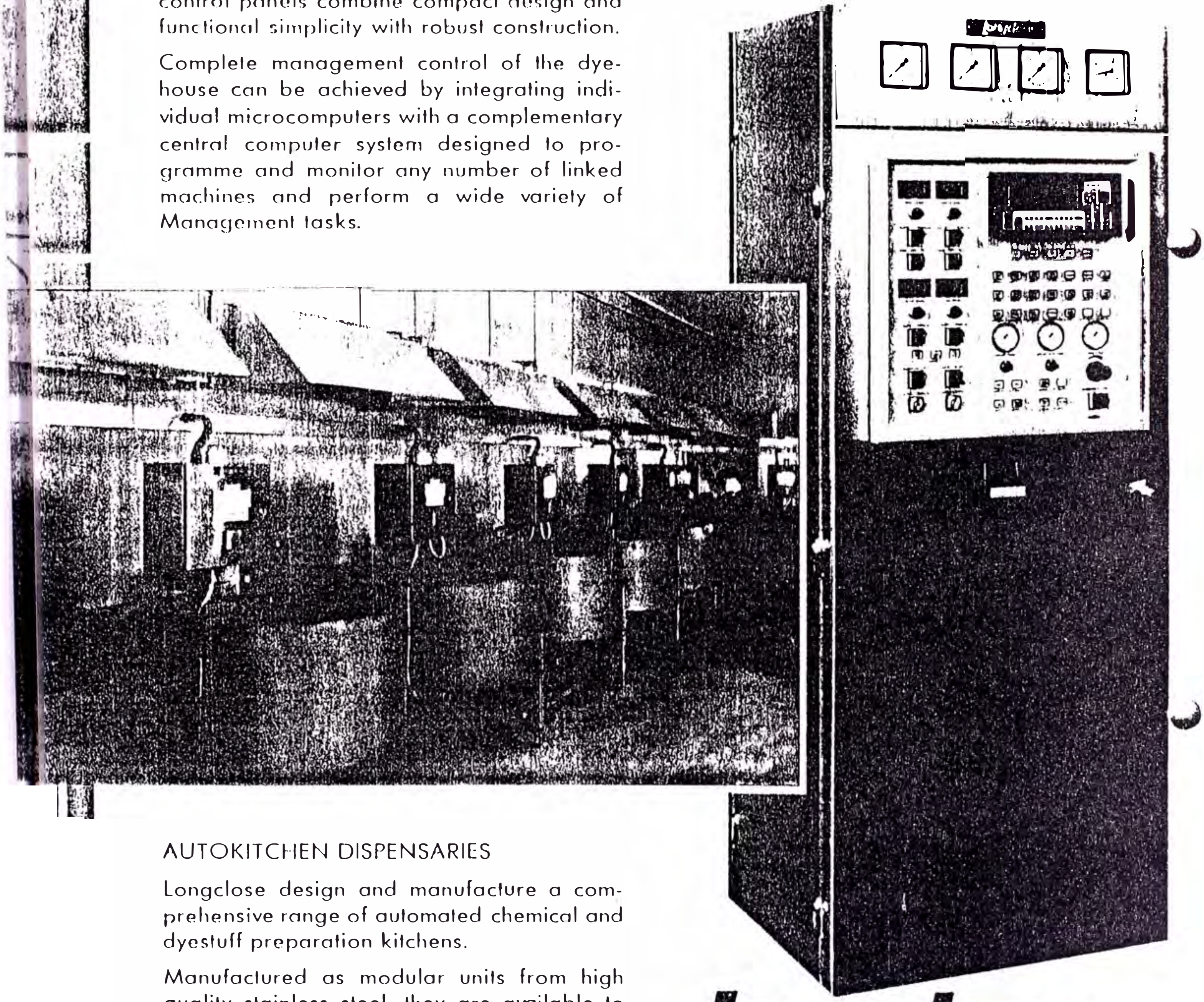
Manufactured to the highest standards the control panels combine compact design and functional simplicity with robust construction.

Complete management control of the dyehouse can be achieved by integrating individual microcomputers with a complementary central computer system designed to programme and monitor any number of linked machines and perform a wide variety of Management tasks.

TECHNICAL SERVICES

Longclose provide a complete process design, installation and commissioning service for the dyehouse environment.

All Longclose installations are backed by a highly skilled service team and rapid-response replacement parts service.



AUTOKITCHEN DISPENSARIES

Longclose design and manufacture a comprehensive range of automated chemical and dyestuff preparation kitchens.

Manufactured as modular units from high quality stainless steel, they are available to suit all machine capacities with a flexible combination of tank sizes and numbers to satisfy all process requirements.

Features include mixers where appropriate, manifold connections, heating facilities, stainless steel valves and transfer pump when necessary.

Longclose LTD.

Dewsbury Road, Leeds LS11 5LH,
West Yorkshire, England.
Telephone: 0113 2709831
Fax: 0113 2760119 Telex: 557477

FIG. 5D.- AUTOCLAVE LONGCLOSE.

快速高溫高壓染紗機

APID HIGH TEMPERATURE HIGH PRESSURE YARN DYEING MACHINE

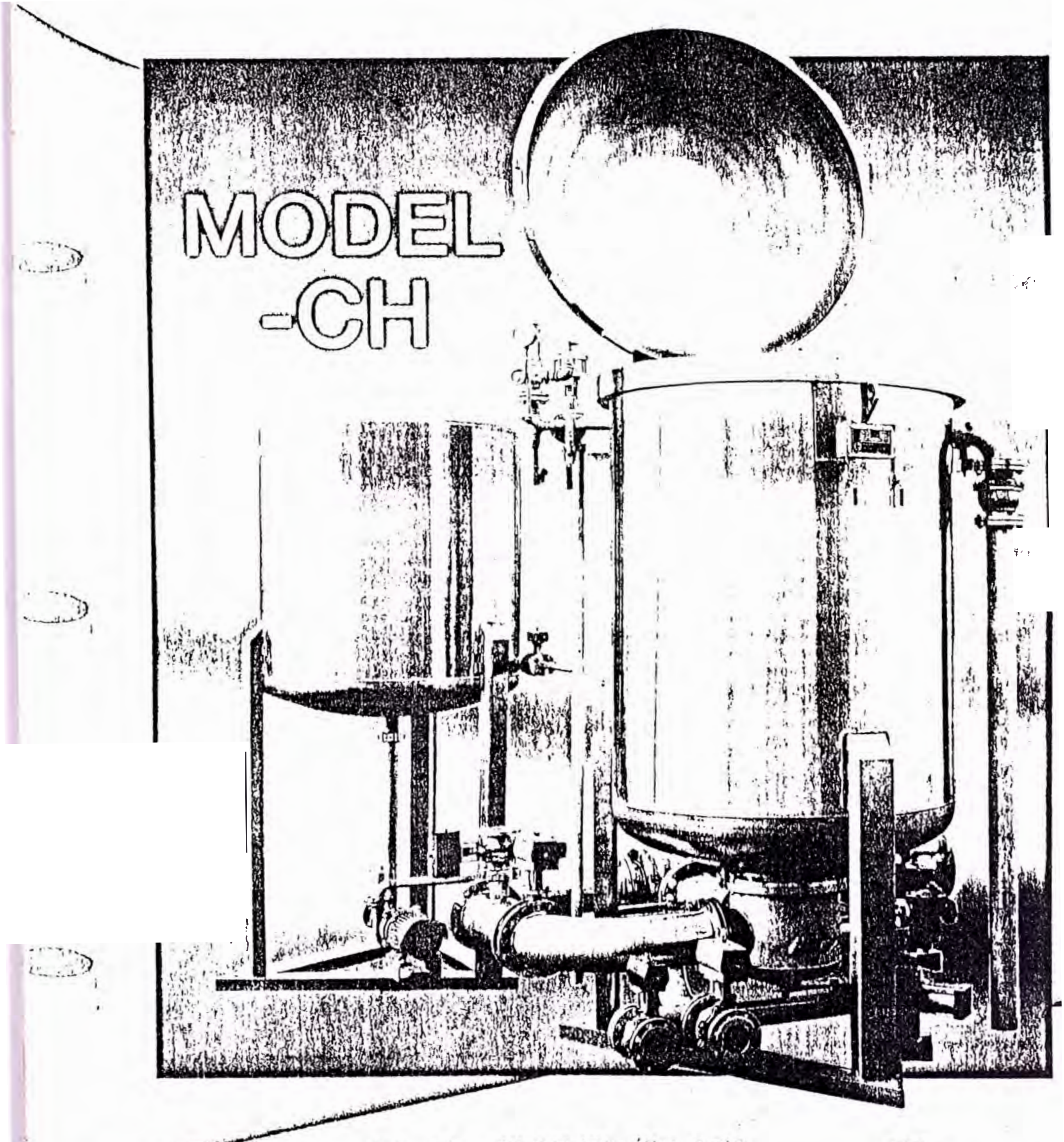
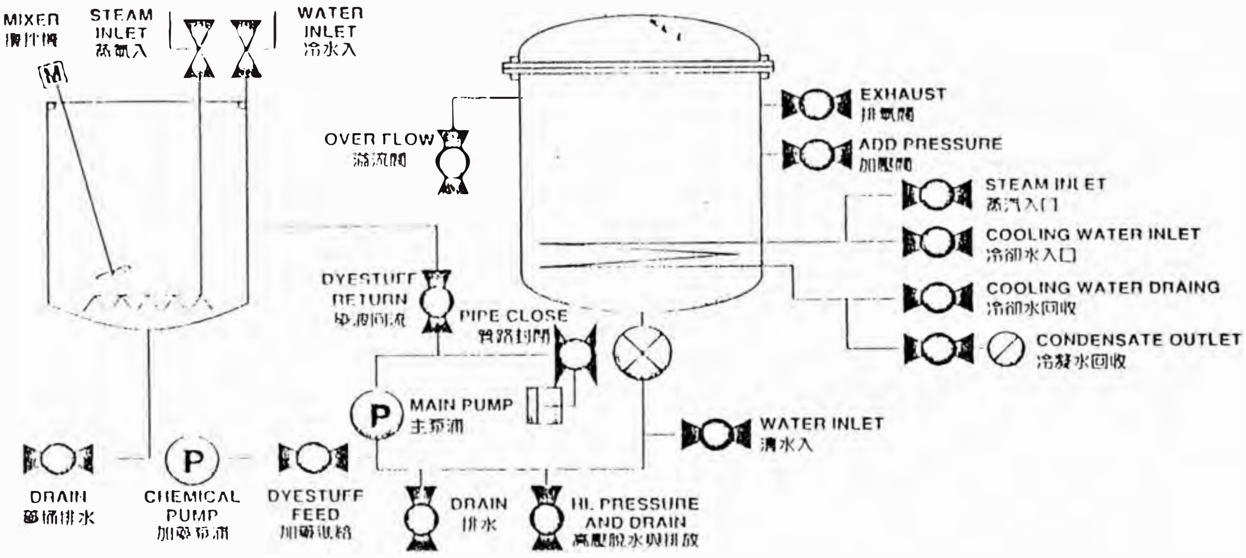


FIG. 5E.- AUTOCLAVE TONG GENG.

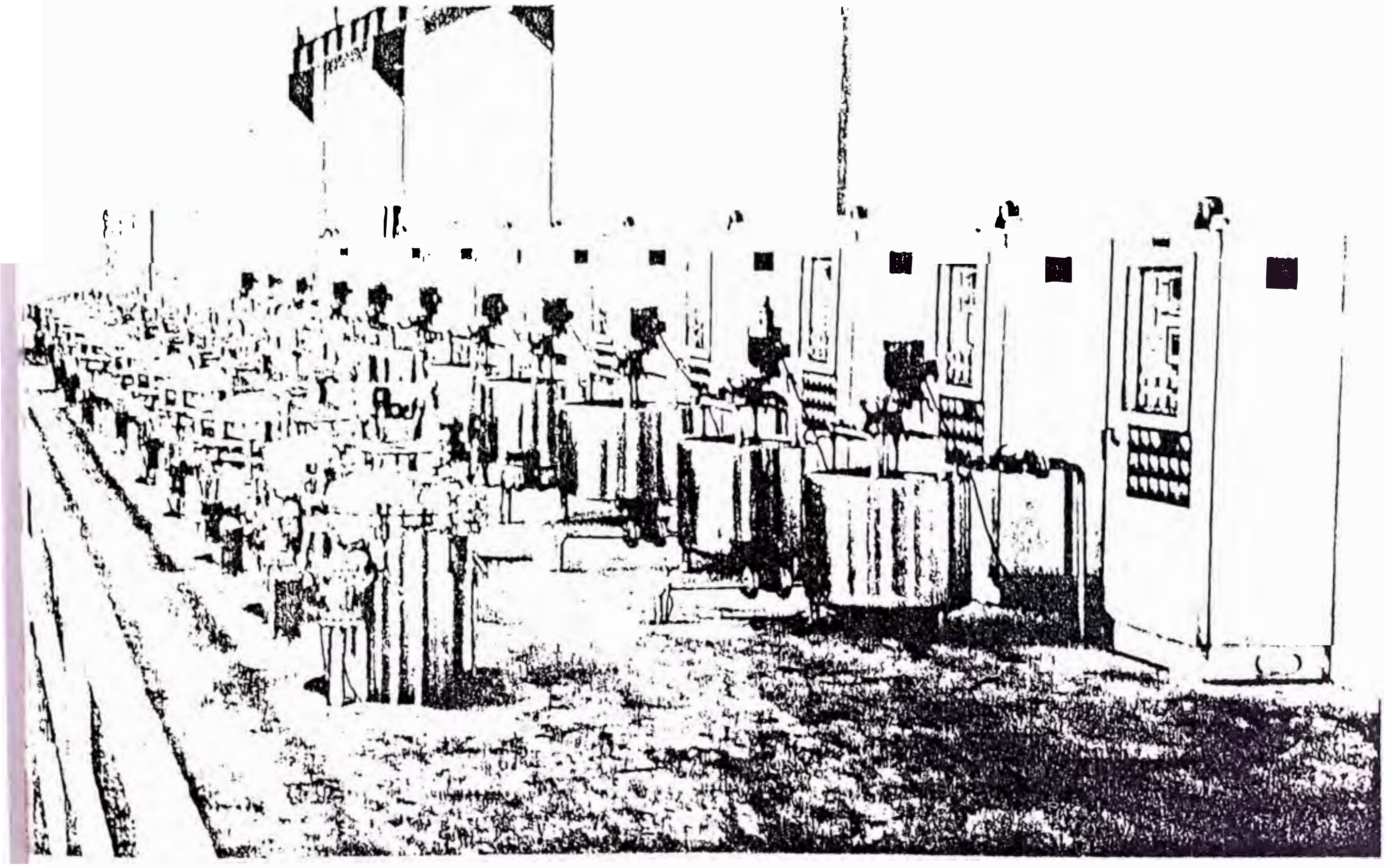
TONG GENG
東庚實業股份有限公司



庚 – TGCH型筒紗染色機器爲氣壓式低浴比設計，適染各種纖維、天然纖維、合 成纖維，多元酯纖維之高壓染色機

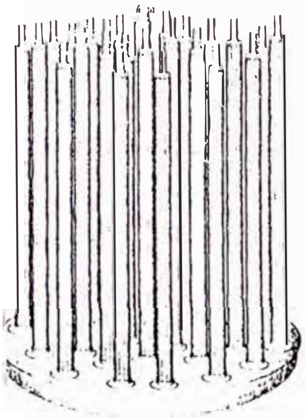
ONG GENG - TGCH type cheese dyeing machine is a pneumatically controlled, high temperature, high ssure dyeing machine, it can be used with a wide variety of fibers (natural, synthetic, polyester etc.) at low uor ratios.

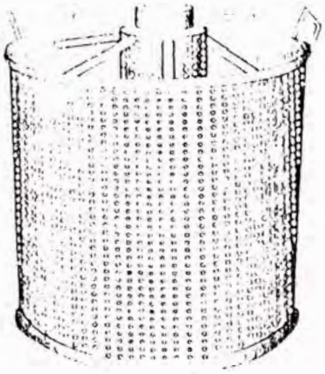
FIG. 5E.- AUTOCLAVE TONG GENG.

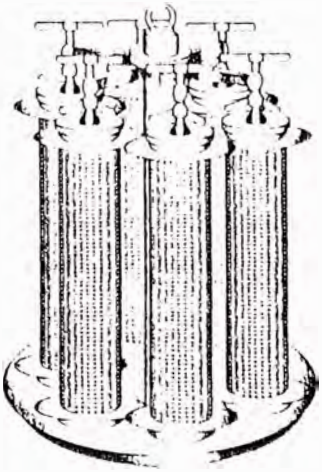


本公司染紗機，可配合下列之染色平板使用。
可依客戶需要製造。
標準之配備則為筒紗平板兩只。

Our yarn-dyeing machines may operate in co-ordination with the following dyeing plates. Standard accessories include two press-type cheese carrier.


（筒紗平板）
Yarn cheese Carrier


（散毛平板）
Loose/Tow/Muff carrier


（樑式紗平板）
Beam Yarn Carrier

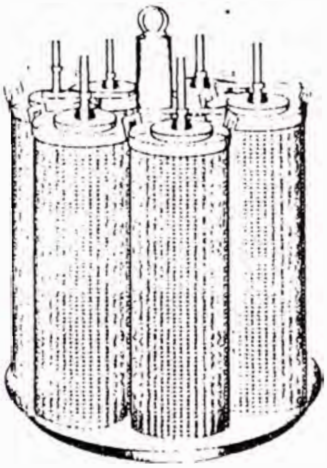
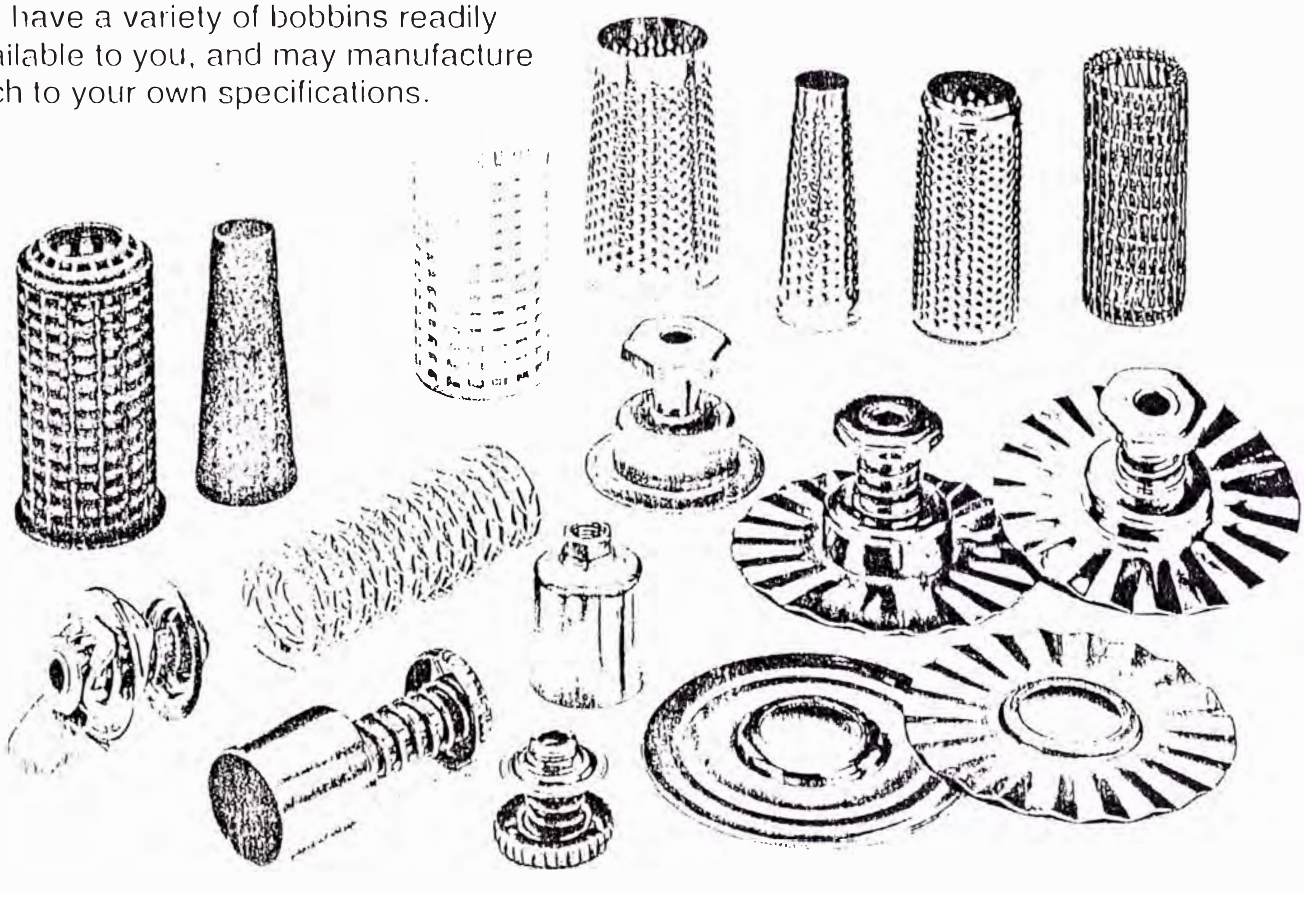

（絞紗平板）
Hank Yarn Carrier

FIG 5E.- AUTOCLAVE TONG GENG.

本公司備有各種紗管，可依客戶需要指定製造。
We have a variety of bobbins readily available to you, and may manufacture such to your own specifications.



東庚TGCH型染色系統　氣壓式浴比低。

1. 染色桶與加料（標準型）
2. 水壓式染色系統
3. 高溫高壓排放系統

以上各項可任顧客之需要選用

TONG GENG economic dyeing system-low liquor technique water and energy saving.

1. Dyeing tank & service tank (Standard Model)
2. Water press type dyeing system.
3. High temperature & High pressure drainage system.

Above can be chosen by customer

SPECIFICATION

型號 MODEL / 項目 ITEM		TGCH-10	TGCH-30	TGCH-50	TGCH-100	TGCH-200	TGCH-300	TGCH-400	TGCH-600	TGCH-1000
最高溫度 Max Temperature°C		140	140	140	140	140	140	140	140	140
最高壓力 Max Pressure kg/cm²		4	4	4	4	4	4	4	4	4
容量 Capacity kg	筒仔 Cheese	10	30	50	100	200	300	400	600	1000
	散毛 Hank	8	25	40	80	160	240	320	480	800
液量 Volume Lit		100	300	500	1000	2000	3000	4000	6000	10000
主泵浦馬達 Main Pump Motor Hp		7.5	10	15	25	40	60	75	125	200
蒸汽用量 Steam Kg/cycle		23	68	113	227	454	680	907	1361	2268
冷卻水量 Cooling water lit/cycle		100	300	600	1200	2400	3600	4800	7200	12000

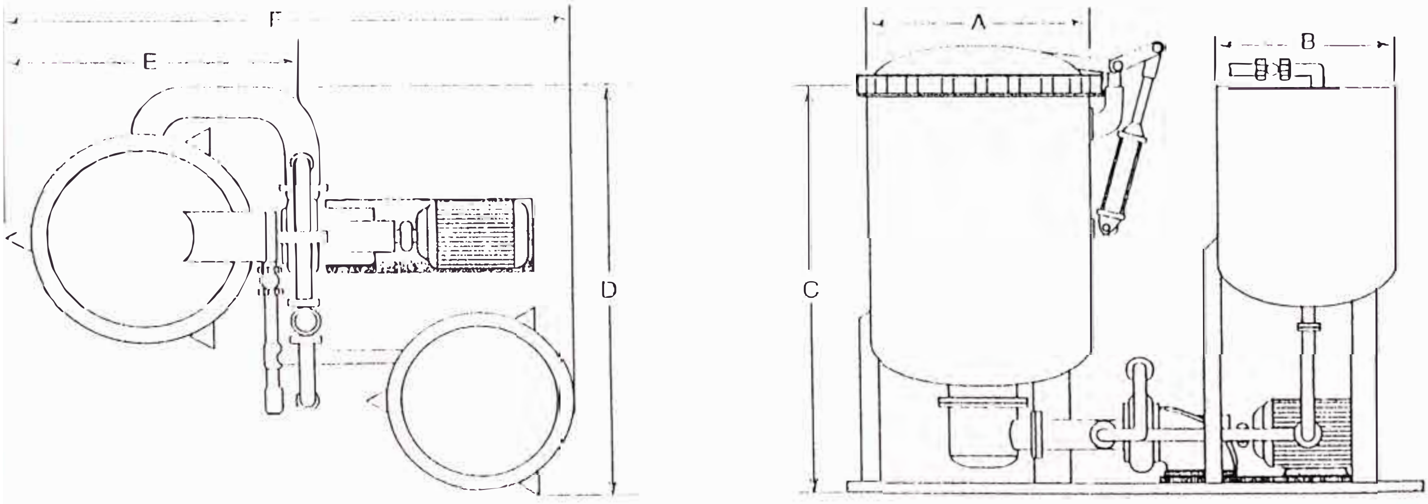


FIG. 5E.- AUTOCLAVE TONG GENG.

SPACE REQUIRED

UNIT:mm

型號 MODEL	A	B	C	D	E	F
TGCH-10	457	635	2735	1856	500	2896
TGCH-30	589	635	2735	1618	570	2984
TGCH-50	770	779	2735	2684	1000	3146
TGCH-100	970	779	2735	2747	1044	3292
TGCH-200	1362	1204	2735	3207	1300	3754
TGCH-300	1572	1375	2785	3350	1300	3940
TGCH-400	1662	1375	2785	3174	1400	3975
TGCH-600	1572	1375	4355	3808	1452	4089
TGCH-1000	1872	1375	5150	3935	1800	4113

＊本公司保有權利變更設計，恕不另行通知。

This company's guarantee applies only to the original item design and is not transferrable.

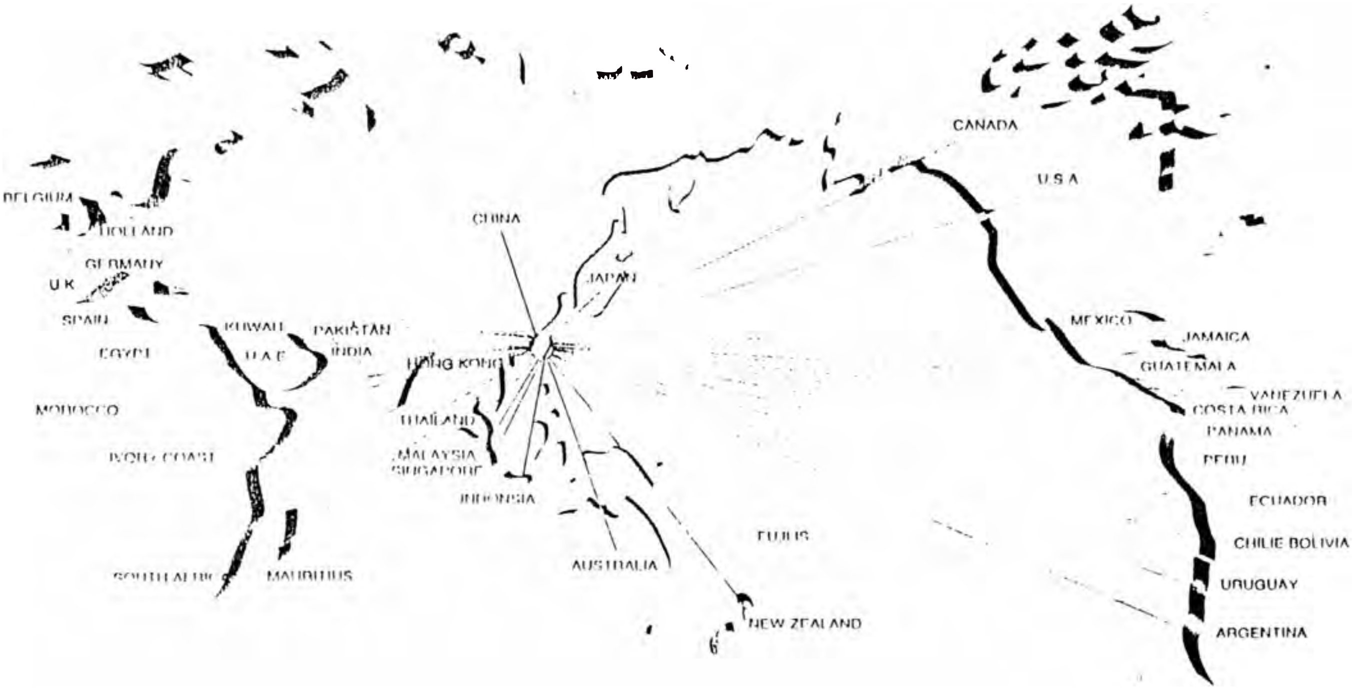


FIG. 5E .- AUTOCLAVE TONG GENG.

主要產品 MAIN PRODUCTS

- 超高速液滿幅布式高溫高壓染布機
  EXTRA-RAPID FULL-FLOW FABRIC-EXTENDING HIGH-TEMP.
  HIGH-PRESSSURE FABRIC DYEING MACHINE
- 超高速 NON-REEL 液滿幅布式高溫高壓染布機
  EXTRA-RAPID NON-REEL FULL-FLOW FABRIC-EXTENDING
  HIGH-TEMP. HIGH-PRESSSURE FABRIC DYEING MACHINE
- 快速常溫常壓染布機
  RAPID NORMAL TEMPERATURE NORMAL PRESSURE
  FABRICARN DYEING MACHINE
- 快速高溫筒仔染紗機
  RAPID HIGH PRESSURE CHEESE YARN DYEING MACHINE
- 快速高壓散毛染紗機
  RAPID HIGH PRESSURE HANK YARN DYEING MACHINE
- 常溫常壓筒仔烘乾機
  NORMAL TEMPERATURE NORMAL PRESSURE CHEESE DRYER
  MACHINE
- 快速高壓筒仔高壓烘乾機
  RAPID HIGH PRESSURE CHEESE DRYER MACHINE
- 筒仔壓紗機
  CHEEESE PRESSURE YARN MACHINE
- 染紗試樣機
  LABORATORY SAMPLE DYEING MACHINE
- 各種化工機械及自動化系統工程之設計及製造銷
  DESIGNING, MANUFACTURING AND VENDING OF CHEMI-E
  MACHINES. AS WELL AS AUTOMATION SYSTEM ENGINEE

TONG GENG
東庚實業股份有限公司
TONG GENG ENTERPRISE CO., LTD.

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(511) 4404421
(511) 4404554
(511) 4429758

TELEFONOS
4221800
4221850
4229666
4404421
4404554
4429758

P.O. BOX - 4192
LIMA - PERU

1996. 6. 10

FIG.6.- CENTRIFUGA.

FIG.6A.- CAMINO A LA SECADORA.

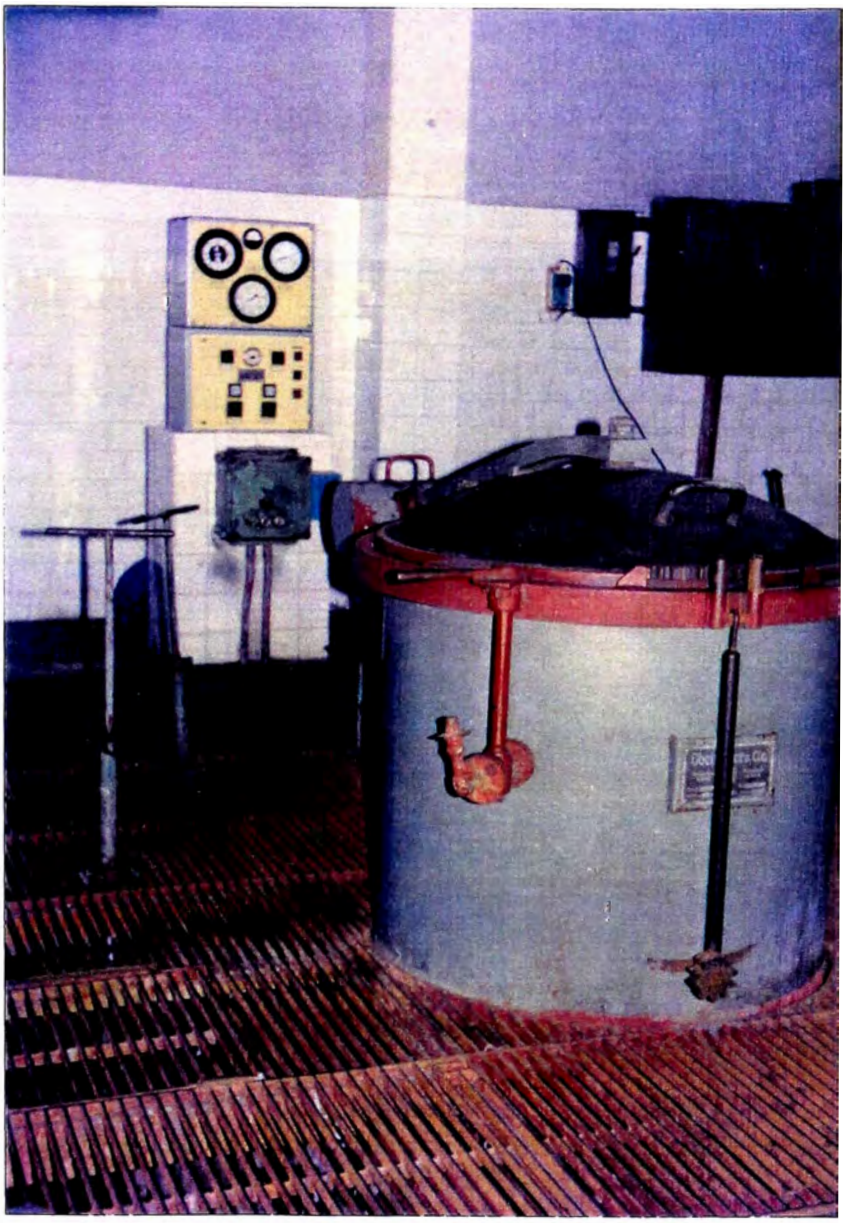


FIG.7.- SECADORA: AIRE CALIENTE.

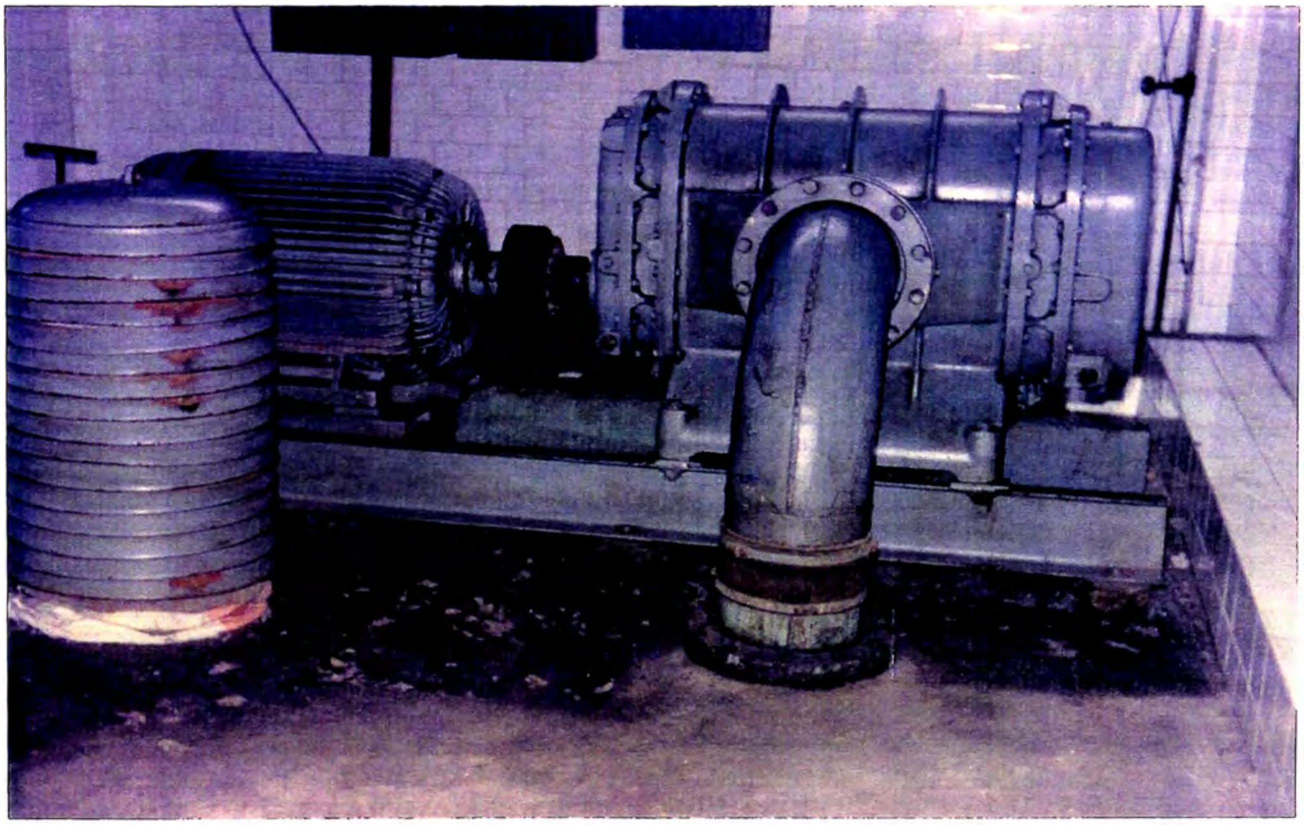
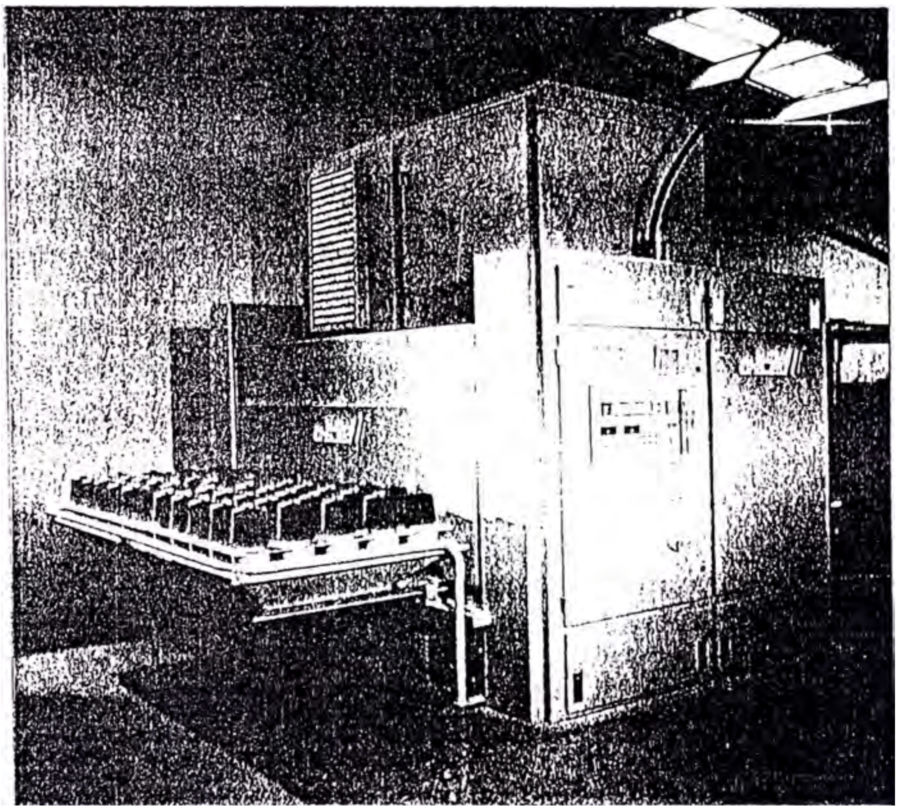


FIG.7A.- COMPRESOR TIPO TORNILLO_SECADORA.

COOL DRY®



WELCOME TO THE FASTRAN COOL DRY® HIGH FREQUENCY (R.F.) SYSTEMS DESIGNED SPECIFICALLY FOR THE DRYING OF TEXTILES. SHOWN ABOVE IS A 60 KW FASTRAN PACKAGE/BUMP DRIER WHICH, AMONG MANY OTHER ADVANTAGES, COMPLETELY ELIMINATES THE NEED FOR HYDROEXTRACTION.

FIG. 8.- SECADORA DE RF: FASTRAN.

WHAT IS COOL DRY?

Fastran "Cool Dry" simply means that during the entire drying cycle the temperature of the textile being processed does not exceed 60°C (140°F).

WHAT ARE THE BENEFITS?

- No yellowing or discolouration.
- Improved fibre quality.
- Elimination of dye migration.
- Energy savings.
- Accurate control of final regain.
- Fully automatic operation using latest P.L.C. (Programmable Logic Control) technology.

HOW IS "COOL DRY" ACHIEVED?

Fastran "Cool Dry" is achieved by the simultaneous use of both Dielectric (R.F.) and Air/Vacuum Technologies.

If R.F. energy is used alone then the water and hence the textile is rapidly and uniformly heated up until the water is eventually removed at or near its boiling point, i.e. 100°C under atmospheric conditions. To reduce the actual drying temperature, Fastran have simply incorporated an additional air flow movement. When air is passed uniformly through the textile product being dried then the actual temperature of drying is reduced to 60°C or less.

WHAT ARE THE MAIN BENEFITS OF "COOL DRY"?

The main benefits are as follows:

1. **Quality**

   It is to be expected that the lower the drying temperature then the lesser the degredation of the textile being processed. This in turn should lead to quality enhancement of the textile. This, in fact, has been found in the industrial field with all "Cool Dry" processed textiles, e.g. for raw/loose stock wool—after subsequent carding, spinning and twisting a yarn yield increase of, on average, 2.0% has been established. Additionally there are other yarn improvements such as greatly increased elasticity and strength, a much more level yarn and with less neps present.

2. **Colour**

   Again, as to be expected, the lower the drying temperature then the lesser the yellowing/discolouration of the textile. This again, has been proved in the industrial field for all textile classes and forms dried by Fastran "Cool Dry". Yellowing is eliminated and the best possible whiteness/brightness on undyed, bleached or dyed bases is obtained. Furthermore, the final shade/colour is completely uniform throughout the whole of the particular lot/batch being dried.

   Cool Dry has also completely eliminated dye migration.

3. **Energy**

   An increased energy utilisation and therefore reduced energy costs is found with "Cool Dry" as:

   (*a*) The water is removed at a much lower temperature than conventional steam/R.F. drying processes, hence less energy is required.

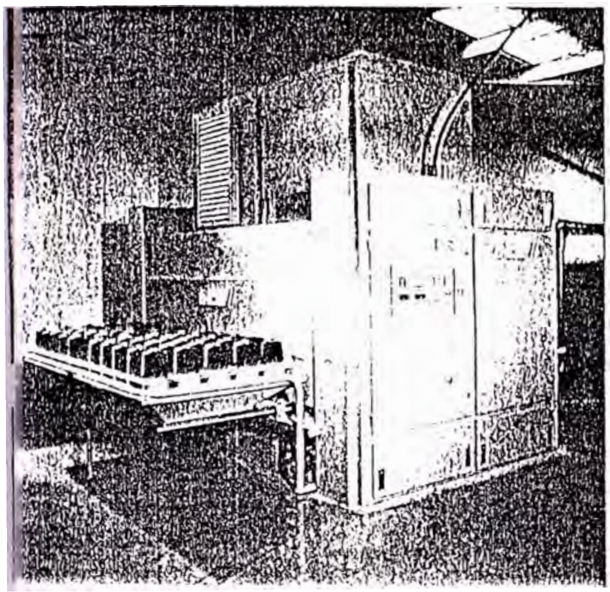
   (*b*) Air movement itself naturally enhances the rate of water removal and the "Cool Dry" concept gives, on average, a removal rate of 1.5 kgs water/hour for every 1kW of actual R.F. energy used/hour.

4. **Moisture Regain**

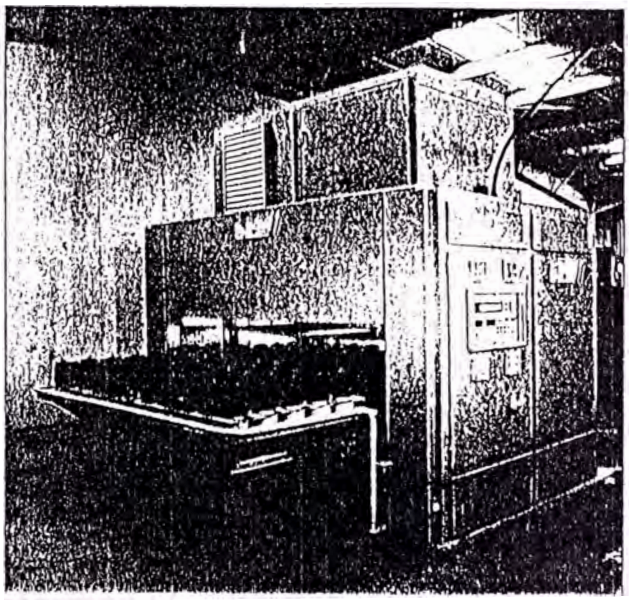
   The final moisture regain can be controlled to within ±1.5% throughout the entire area/mass of the textile being processed. This is true for all textile forms, including packages and bumps, which present the most severe barriers for normal drying.

Mode of Operation

As simple as A B C

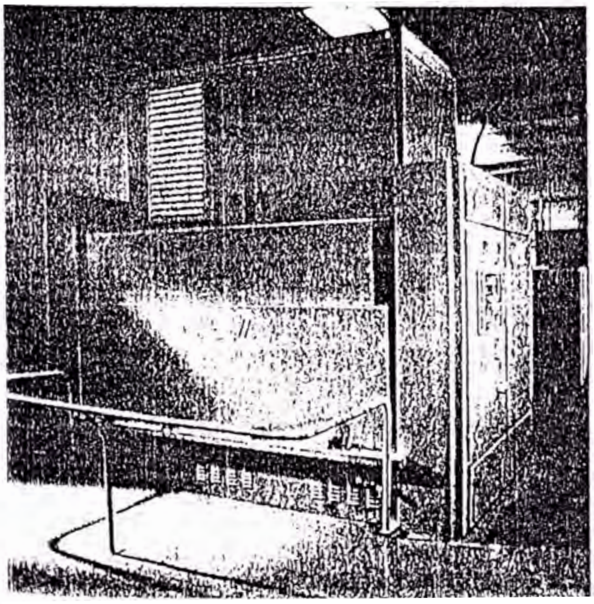


A *Load tray with wet packages — press ready button*

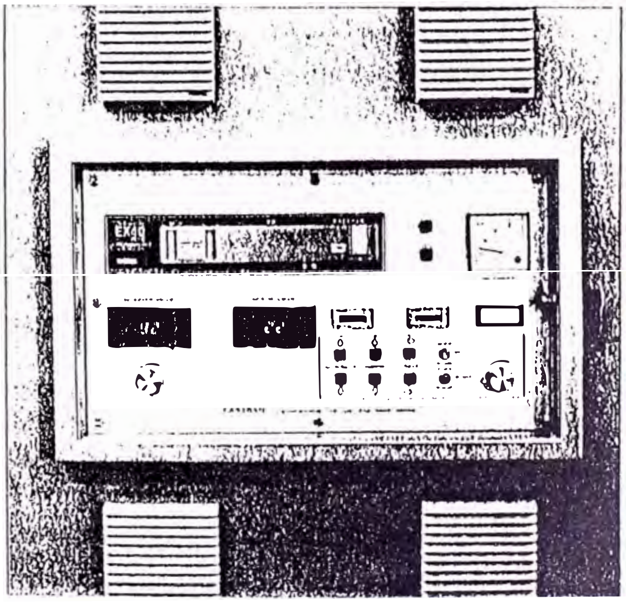


Trays automatically interchange when drying cycle is complete B

FIG. 8.- SECADORA DE RF: FASPRAN



C *Tray now being processed. When drying cycle is complete, system will revert to A.*

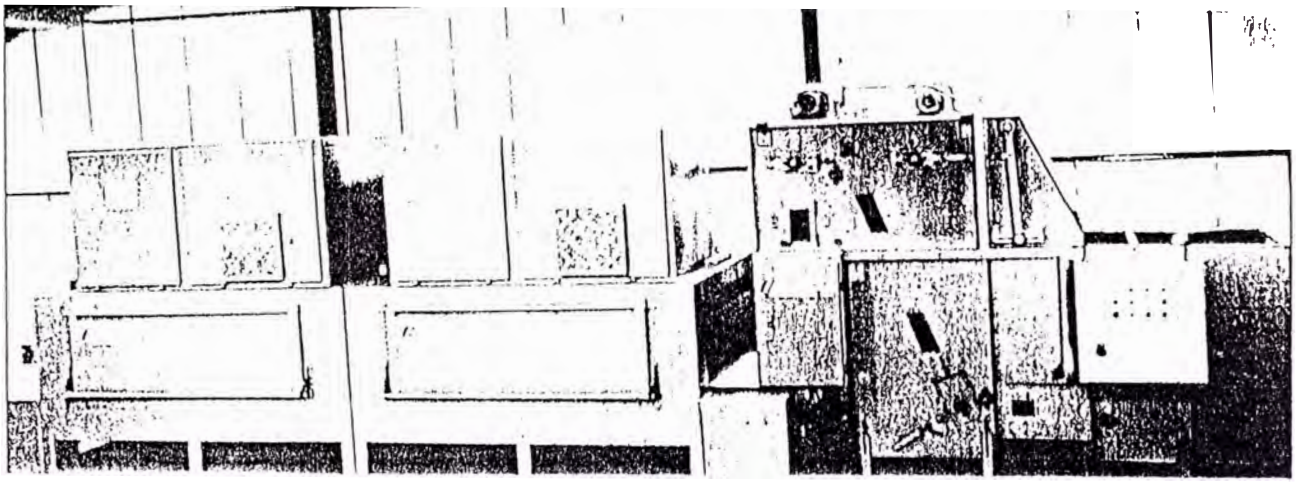


The mode of operation is simplified by using the latest P.L.C. Technology. This gives the facility to pre-set the drying cycle to give the required moisture regain of the product being processed.

COOL DRY®

Conveyor Type Drier

THE CONVEYOR TYPE DRIER CAN BE USED FOR DRYING OF TOPS, TOW, HANKS, GARMENTS AND LOOSE STOCK.



FG. 8.- SECADORA DE RF: FASTRAN.

90kW R.F. Loose Stock Drier

Fastran Conveyor Type Driers use the same "Cool Dry" principle of combining radio frequency energy with air vacuum to give temperature control of the product being dried.

These systems can be supplied in modular form using 30kW and 60kW generators. For loose stock only an additional integrally linked volumetric hopper is supplied. The full line is automatically controlled via a programme selector to give final regain control of ± 1.5%.

BENEFITS

- Reduction in energy costs.
- Low temperature drying has eliminated shade discolouration and yellowing.
- Quality of fibre improved.
- After subsequent processing (carding and spinning) there is an increase in yarn yield.
- Control of moisture regain after dying is now within ± 1.5%.
- Temperature of product being dried does not exceed 60°C (140°F).
- Contamination between shades virtually eliminated.
- Cleaning of the drier has been reduced to approximately three minutes.
- Easier installation, feeding and drying of material are interlinked.
- The need to preheat the electrode cabinets with conventional hot air is now eliminated, again saving in energy.
- No warm or shut down times are necessary, instantaneous power control with no thermal inertia.
- By using air flow combined with R.F., efficiency is approximately 80% giving savings in energy.
- Working environment improved.

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COOL DRY

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FIG. 8.- SECADORA DE RF: FASTRAN.

FASTRAN "COOL DRY"

ran Engineering Limited was set up originally by the Dawson International Group". Dawson, a large vertical textile ıp, specialise in the dyeing, spinning, knitting and weaving of all types of wool fibres.
v are specially noted for their high quality cashmere products. As part of their research and development Fastran asked to produce an R.F. drying system that would improve the colour, quality and feel of their finished lucts. With these objectives in mind we looked at combining the use of R.F. energy and air flow. The first machine developed was for the drying of loose stock fibres. The results achieved were better than we had envisaged.

CONVEYOR DRYER

basic principle of the machine is as follows:

base of our conveyor is constructed to form a vacuum box and acts as a bottom electrode, the material is conveyed igh the dryer on a perforated belt. Attached to the base of the vacuum box we connect two low energy fans that can air through the product as the R.F. energy is applied. The energy required to pull air through loose stock fibre is small and the pressure above and below the fibre is measured in only inches water gauge. It has been discovered the R.F. energy will move the water held by the fibre from the inside to the surface of the fibres, and by combing with the flow of warm air we can remove the moisture very efficiently. The normal removal rate for moisture is oximately 1.2kgs\kw of R.F. energy. However, by combining the R.F. energy with the air flow we achieve oximately 1.5kgs\kw. The generator is mounted on top of the R.F cabinet and the warm air from the oscillator ing system is directed into the electrode housing and this air, mixed with ambient air, is pulled through the uct. In consequence a minimum overall efficiency of 80% for the dryer is obtained. The degree of temperature ie product can therefore be controlled by the flow of air and gives the following benefits:

o yellowing of the fibres or discoloration of pastel shades.

ie ability to produce a much brighter white after bleaching.

higher efficiency than other alternative R.F. dryers.

ie air flow through the dryer prevents cross contamination between batches as residual dye from the previous oduct is eliminated.

ie quality of the fibre is vastly improved and therefore carding and spinning runs more efficiently. The Fastran F. conveyor process will guarantee an increase of 2% from raw material to yarn produced.

ie temperature of the product does not exceed 60 oC.

to the downward movement of air there is no need to preheat the electrode cabinet to prevent condensation.

is a brief description of the Fastran conveyor dryer and the significant benefits the equipment provides. For num results the operation of the R.F. conveyor dryer is dependent upon the level flow of the material to be essed and Fastran recommend the installation of a volumetric hopper to feed the dryer for loose stock applications. control system we use is fully automatic and the desired level of energy can be preset before the conveyor is switched on, by combining the R.F. dryer with the hopper we can electrically link both units. For changes aterial a 6-way selector switch will programme the complete line. This eliminates the need for the operator set the controls each time the product is changed. This is an important feature as textile mills do not normally loy skilled labour and the simpler the method of operation the more easily it becomes adopted by the industry.

FIG. 8.- SECADORA DE RF: FASTRAN.

To summarise, we normally recommend the use of the conveyor dryer for products such as loose stock, tops or tow. The drying packages we recommend our standard package dryer, however we can also use the conveyor dryer for packages, after all, this is the only method used by our competitors. There are two cases where using the conveyor is beneficial:

When the packages are wound on stainless steel centres.

When the product to be dried is polyester and therefore the control of temperature is less important, also polyester can be hydro-extracted to approximately 15% and normally the production runs are very much larger.

PACKAGE DRYER

The principle used for drying packages is basically the same as adopted for the conveyor dryer. However, the constuction of the R.F. dryer and the method of producing the air flow are very different.

The packages are loaded onto a twin tray shuttle system and the trays are mechanically linked together such that, when one tray is inside the machine the other is outside for product retrieval and reloading. When the packages inside the dryer have reached the desired regain the PLC will automatically change over the trays. The operator merely initiates the start button when he has reloaded the tray. It should be noted that the RF cycle can only operate when both doors are closed.

The drying cycle is fully automatic and the desired regain can be preset for the machine to switch off when this point is reached. For each material a set point is initiated in the machine and the amount of energy and the final regain are automatically preset. However, in many cases the same set point can be used for various materials. Again, the operation is made very simple and the operator is not required to make any adjustments to control the final regain of the product.

The air flow through the package is developed by utilising a Positive Displacement Pump. Each tray can be loaded with 50 packages and when the trays change over a vacuum connection on the underside of the machine opens and closes. When the tray is in place and the vacuum is selected the air is pulled through the packages and displaced through the pump.

When using an alternative conventional R.F. dryer the packages must be hydro-extracted first, with the Fastran unit it is possible to take the packages direct from the dye bath. The initial liquid is removed by the vacuum pump. This can be very important on fragile fibres as the hydro process can cause mechanical damage to the products.

Benefits

No yellowing or discolouration of the dried product.

The ability to produce a much brighter white after bleaching.

The elimination of dye migration.

Due to accurate temperature control it is possible to use a wide range of dyes

The drying of acrylics presents no problems.

Quality of the yarn greatly improved hence greater efficiency during back winding, weaving and knitting.

By using the maximum available vacuum, packages can be dried without prior hydro-extraction

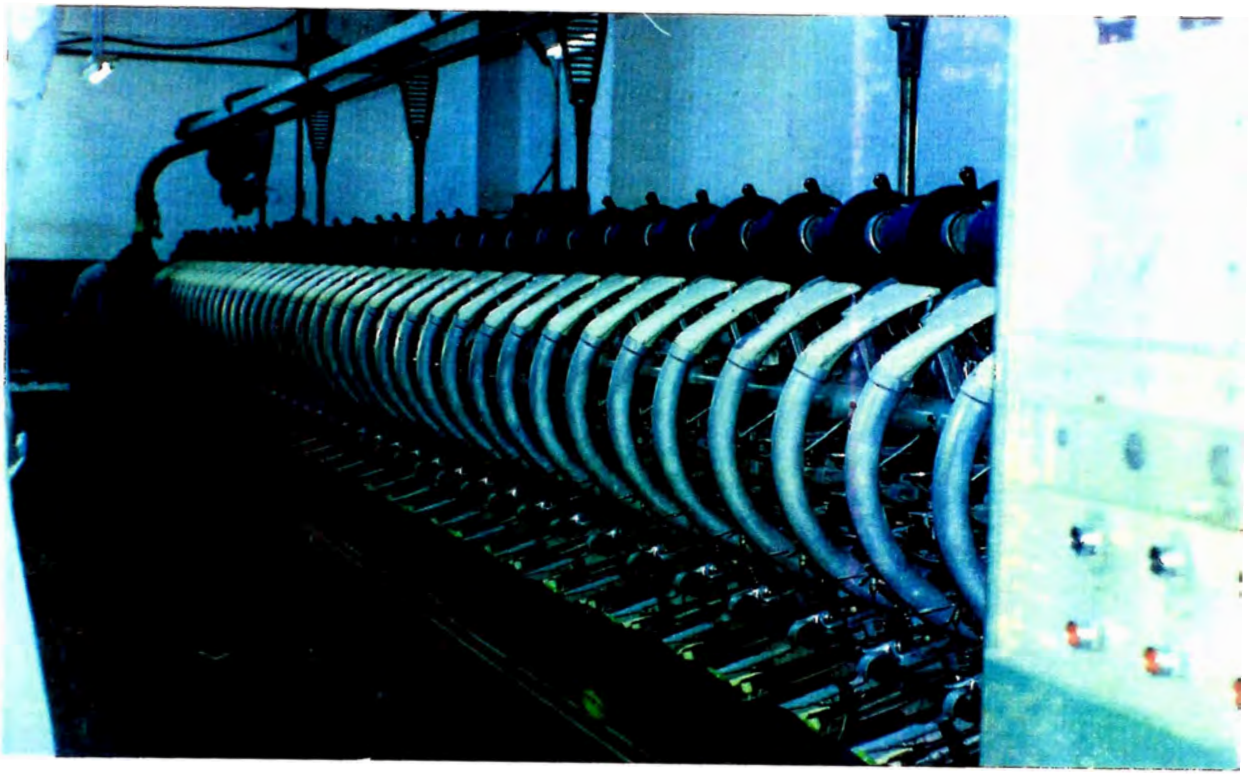


FIG.9._REENCONADO DE BOBINAS.

FIG.9A._ SECUENCIA DEL TEÑIDO.

FIG. 10.- HILO TEÑIDO Y ENVALADO.

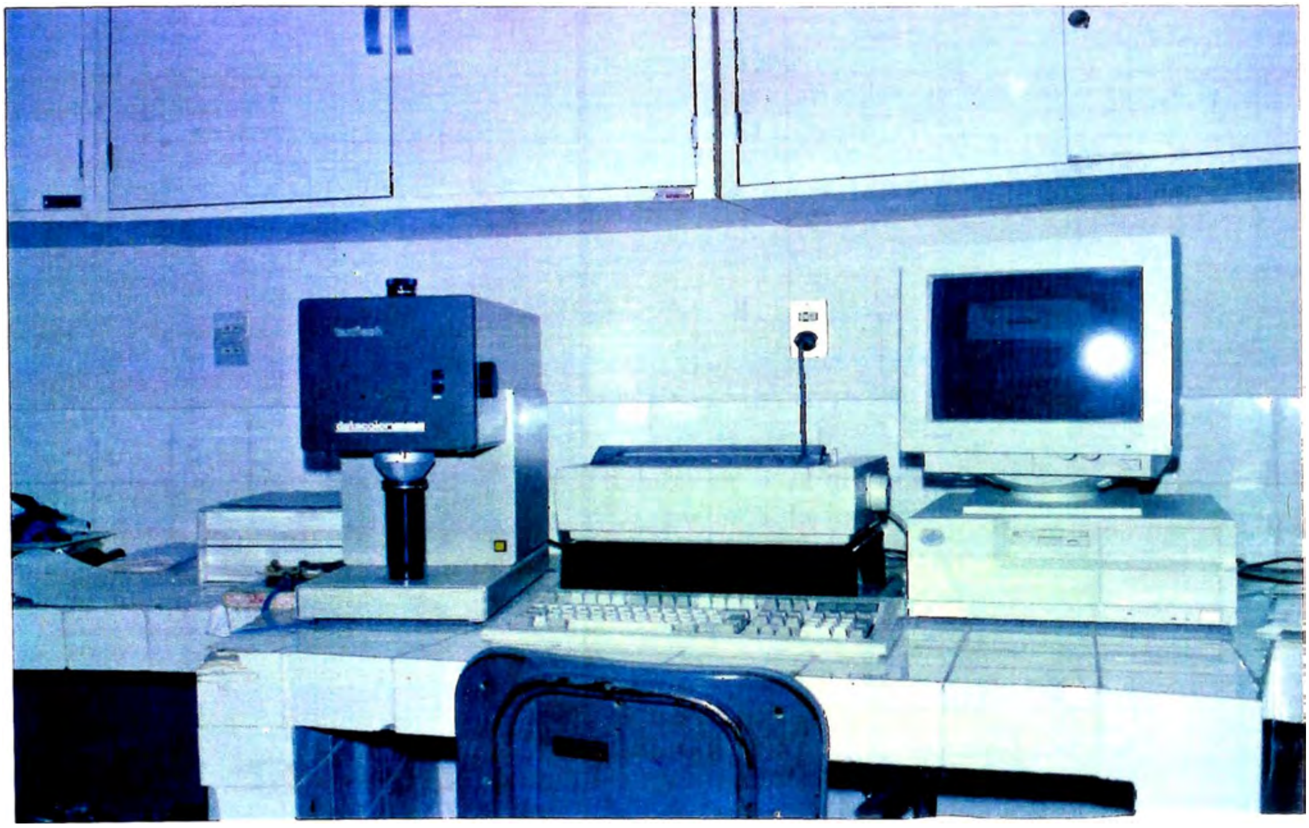
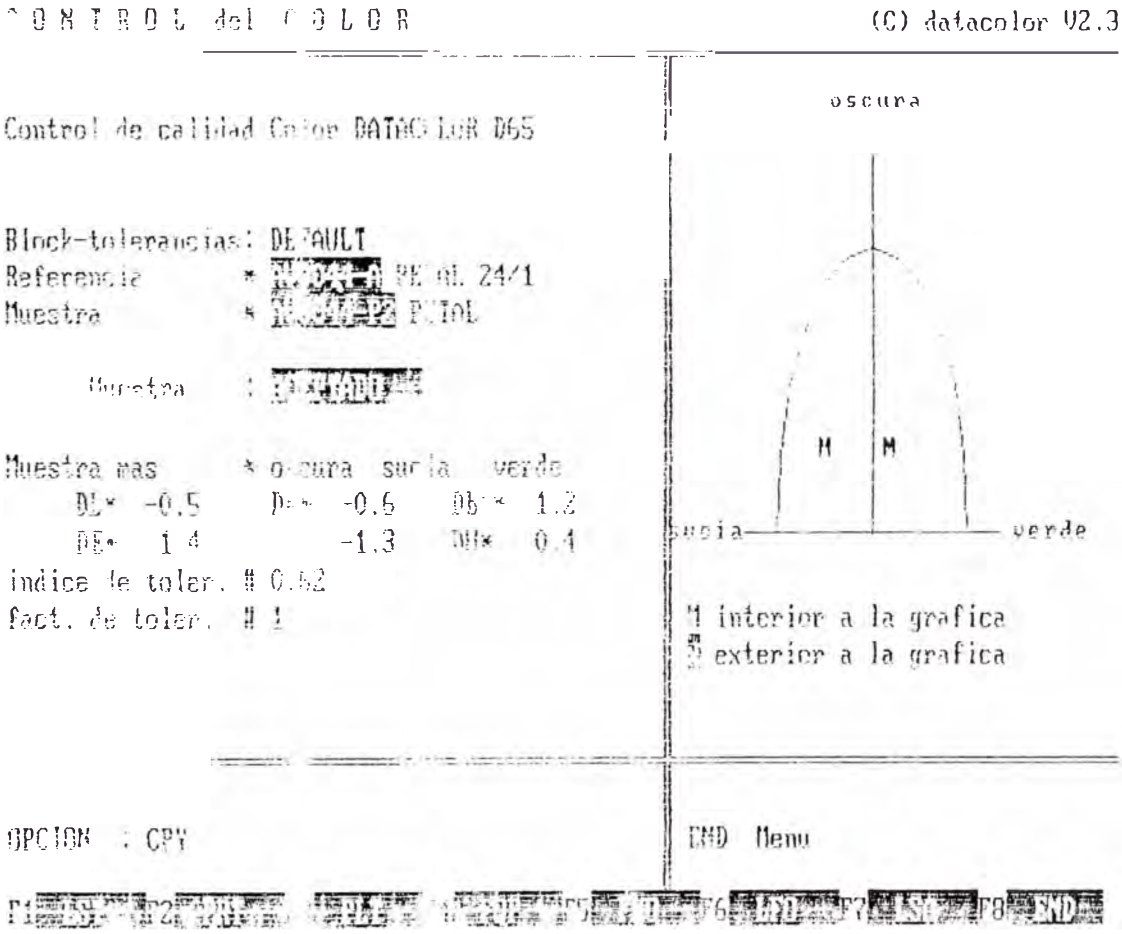


FIG.11.- datacolor PARA EL CONTROL DEL COLOR.

FIG. 11 A



```
C O N T R O L  del  C O L O R                                (C) datacolor V2.3

Control de calidad Color DATACOLOR D65                        oscura

Block-tolerancias: DEFAULT
Referencia       * [illegible] PE OL 24/1
Muestra          * [illegible] P.TOL

     Muestra     : [illegible]

Muestra mas      * oscura  sucia   verde
     DL*  -0.5      Da*  -0.6     Db*  1.2
     DE*   1.4           -1.3     DH*  0.4
indice de toler. # 0.52
fact. de toler.  # 1

                                            M interior a la grafica
                                            M exterior a la grafica

OPCION  : CPY                               END  Menu

F1 [illegible] F2 [illegible] F5 [illegible] F6 [illegible] F7 [illegible] F8 END
```

FIG. 11 D

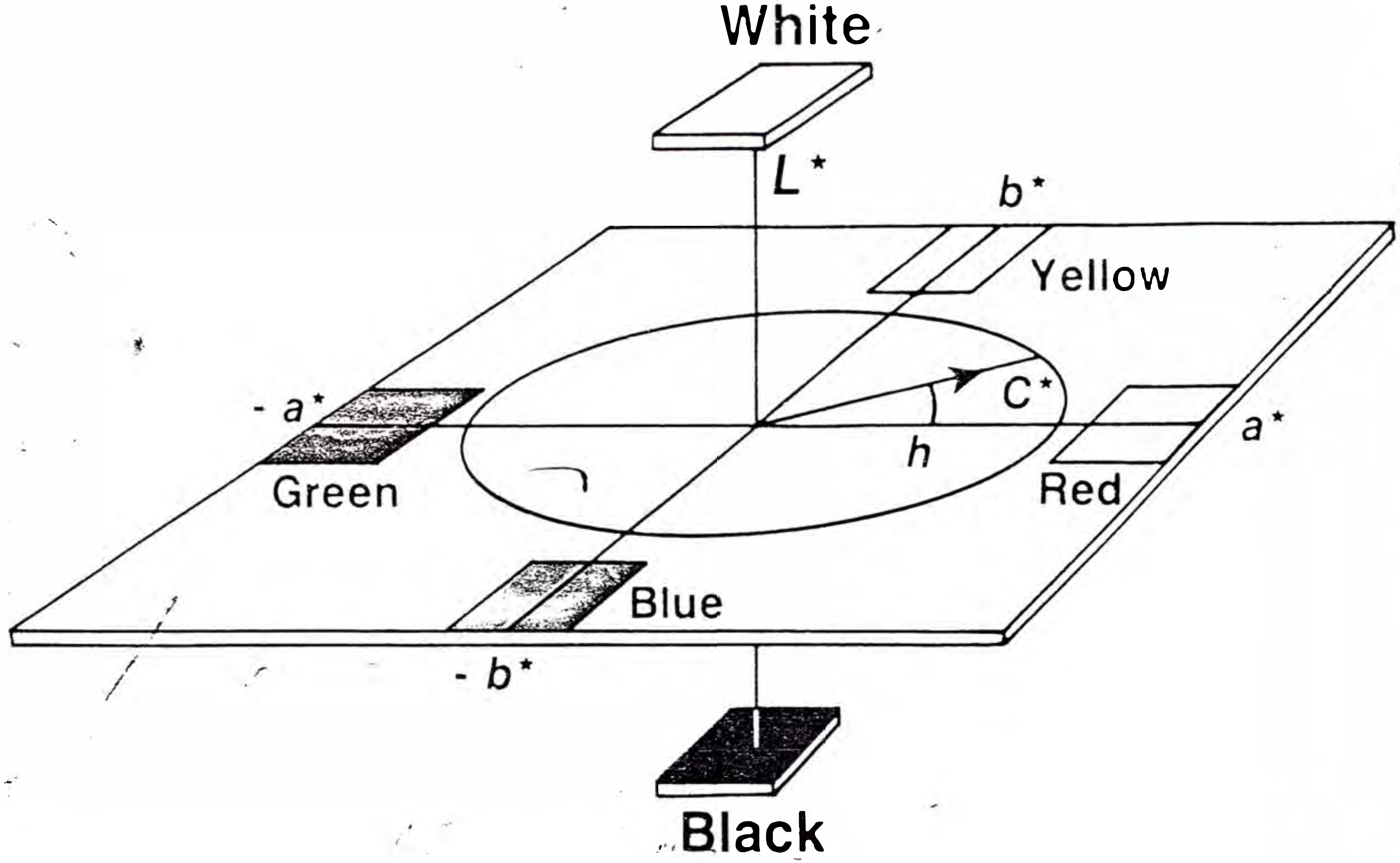


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FIG. 12.- TENSIOMETRO: MIDE RESISTENCIA DEL HILO.

ANEXO 01

AATCC Test Method 81-1980

pH of the Water-Extract from Bleached Textiles

Developed in 1954 by AATCC Committee RA34; revised 1963; reaffirmed 1968, 1969, 1974, 1977, 1980.
(Same as ANSI L14.116-1964/R1971)

1. Purpose and Scope

1.1 The pH of the water-extract from fibers, yarn, or fabric samples indicates the efficiency of the washing operation after various wet treatments, particularly, bleaching. The pH value is an important factor in further treatments such as dyeing or finishing.

2. Principle

2.1 The specimen is boiled for 10 minutes in approximately 25 times its weight of distilled water. The water-extract is cooled to room temperature and the pH is determined.

3. Apparatus and Materials

3.1 pH meter
3.2 Beaker, 400-ml
3.3 Watch glass
3.4 Water, distilled

4. Test Specimen

4.1 Use a 10 ± 0.1 gram specimen of the material to be tested. If the weight per square yard of the fabric is excessively low, cut sample into small pieces.

5. Procedure

Boil 250 ml of distilled water at a moderate rate for 10 minutes. Immerse the specimen, cover the beaker with a watch glass and boil for an additional 10 minutes.

5.2 Allow covered beaker and contents to cool to room temperature. Remove contents with tweezers, allowing all excess liquid to drip back into extract.

5.3 Determine the pH of the extract using a pH meter operated according to the manufacturer's instructions.

6. Evaluation

6.1 The pH of the water-extract depends on the chemical treatment previously given the material, the pH of the wash-water and the efficiency of the washing operation.

6.2 Normally, the pH of the water-extract will be higher after caustic boiling than after bleaching. If the material is soured after bleaching the pH may be lower.

ANEXO_02

B02:
Colour fastness to artificial light: Xenon arc fading lamp test

NOTE. This method is applicable to leather. See Introduction to UK-L.

1 Scope and field of application

1.1 This part of ISO 105 specifies a method intended for determining the resistance of the colour of textiles of all kinds and in all forms to the action of an artificial light source representative of natural daylight (D_{65}). The method is also applicable to white (bleached or optically brightened) textiles.

1.2 If there is a possibility of the sample being photochromic, then the test for photochromism shall be applied additionally (see ISO 105-B05).

1.3 This method employs two sets of Blue Wool References. The results from the two sets of references may not be identical.

NOTE — General information on colour fastness to light is given in annex C.

2 References

ISO 105, *Textiles — Tests for colour fastness —*

Part A01: General principles of testing.

Part A02: Grey scale for assessing change in colour.

Part B01: Colour fastness to light: Daylight.

Part B05: Detection and assessment of photochromism.

CIE Publication No. 51, *Method for assessing the quality of daylight simulators for colorimetry.*

3 Principle

A specimen of the textile is exposed to artificial light under prescribed conditions, along with Blue Wool References. There are two different sets of Blue Wool References which are not interchangeable. The colour fastness is assessed by comparing the change in colour of the specimen with that of the references used.

For white (bleached or optically brightened) textiles the fastness is assessed by comparing the change of whiteness of the specimen with that of the references used.

4 Reference materials and apparatus

4.1 Reference materials

Two sets of Blue Wool References may be used. The two sets of references are not interchangeable.

4.1.1 References 1 to 8

Blue Wool References developed and produced in Europe are identified by the numerical designation 1 to 8. These references are blue wool cloths dyed with the dyes listed in the table. They range from 1 (very low light fastness) to 8 (very high light fastness) so that each higher numbered reference is approximately twice as fast as the preceding one.

Table — Dyes for Blue Wool References 1 to 8

Reference	Dye — Colour Index designation[1]
1	CI Acid Blue 104
2	CI Acid Blue 109
3	CI Acid Blue 83
4	CI Acid Blue 121
5	CI Acid Blue 47
6	CI Acid Blue 23
7	CI Solubilized Vat Blue 5
8	CI Solubilized Vat Blue 8

[1] *The Colour Index* (Third edition) is published by the Society of Dyers and Colourists, P.O. Box 244, Perkin House, 82 Grattan Road, Bradford BD1 2JB, West Yorks., United Kingdom, and by the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, North Carolina 27709, USA

4.1.2 References L2 to L9

Blue Wool References developed and produced in America are identified by the letter L followed by the numerical designation 2 to 9. These eight references are specially prepared by blending varying proportions of wool dyed with CI Mordant Blue 1 (Colour Index, Third edition, 43830) and wool dyed with CI Solubilized Vat Blue 8 (Colour Index, Third edition, 73801), so that each higher numbered reference is approximately twice as fast as the preceding reference.

The relationship shown in figures 1 and 2 between the two sets of Blue Wool References is a numerical rather than a performance relationship.

1.1.3 Humidity test control

The humidity test control is a red azoic dyed cotton cloth see 9.3).

.2 Apparatus

.2.1 **Xenon arc lamp apparatus**, either air-cooled or water-cooled.

he specimens and the references are exposed in one of the vo ty of apparatus (see 4.2.1.1 and 4.2.1.2). The variation f the light intensity over the area covered by the specimens nd references shall not exceed ± 10 % of the mean.

he distance from the surface of the specimen and that of the ferences to the lamp shall be the same.

2.1.1 **Air-cooled xenon arc lamp apparatus** (see nex A), consisting of the following elements:

a) **Light source**, in a well ventilated exposure chamber.

The light source is a xenon arc lamp of correlated colour temperature 5 500 to 6 500 K.

b) **Light filter**, placed between the light source and the specimens and references so that the ultra-violet spectrum is steadily reduced. The transmission of the glass used shall be at least 90 % between 380 and 750 nm, falling to 0 % between 310 and 320 nm.

c) **Heat filter**. The spectrum of the xenon arc contains an appreciable amount of infra-red radiation which shall be minimized by heat filters (see 9.1, A.1.1 and A.2.2).

d) **Exposure conditions**. (The light fastness ratings mentioned below are obtained with the Blue Wool References 1 to 8 only):

1) Normal conditions (temperate zone): moderate effective humidity (see 9.3); light fastness of the humidity test control: 5; maximum black panel temperature 45 °C (see 9.2).

2) Extreme conditions: For testing sensitivity of specimens to different humidity during irradiation, the following extreme conditions are useful:

— low effective humidity: light fastness of the humidity test control: 6 to 7; maximum black pane temperature: 60 °C (see 9.2);

— high effective humidity: light fastness of the humidity test control: 3; maximum black panel temperature: 40 °C (see 9.2).

4.2.1.2 **Water-cooled xenon arc lamp apparatus** (see annex B), consisting of the following elements:

a) **Light source**, in a well ventilated exposure chamber

Light sources are long-life xenon arc lamps of various sizes depending on the size of the apparatus (see B.1.1 and B.2.1).

b) **Light filter**. Inner and outer filter glass containing and directing the flow of cooling water. An inner filter of P (borosilicate) glass and an outer filter of clear (soda-lime) glass are used so that the irradiation at the specimen has a lower spectral cut-off at approximately that of window glass (see B.1.2).

c) **Heat filter**. Distilled or deionized water circulating through the lamp assembly between the inner and outer filter glass, cooled by passing through a heat-exchange unit (see B.1.4).

d) **Exposure conditions**. Black panel temperature 63 ± 1 °C (see 9.2), controlled by continuous operation of the blower with thermostatic control of the temperature of a constant volume of air, whose relative humidity is increased by adding moisture to the air as it passes through the conditioning chamber by means of an electrically operated atomizer; the controls of the apparatus are adjusted so that the relative humidity of the air in the test chamber is (30 ± 5) %.

Effective humidity: low.

Light fastness of the humidity test control: 6-7.

4.2.2 **Opaque cardboard**, or other thin opaque material, for example thin sheet aluminium or cardboard covered with aluminium foil.

4.2.3 **Black panel thermometer** (see 9.2).

4.2.4 **Grey scale for assessing change in colour** (see clause 2).

4.2.5 Colour matching lamp, complying with CIE Publication No. 51, for assessment of the change in whiteness.

5 Test specimens

Depending on the number of specimens to be tested and on the shape and dimensions of the specimen holders supplied with the apparatus, the size of the specimen may vary.

5.1 In apparatus of the air-cooled type, usually an area of the textile not less than 4,5 cm × 1 cm is used when several periods of exposure are made side by side on the same specimen, which is the preferred practice. The specimen may be a strip of cloth, yarns wound close together on a card or laid parallel and fastened on a card, or a mat of fibres combed and compressed to give a uniform surface and fastened on a card. Each exposed and unexposed area shall be not less than 10 mm × 8 mm.

5.2 To facilitate handling, the specimen or specimens to be tested and the similar strips of the references may be mounted on one or more cards as indicated in figure 1 or figure 2.

5.3 In apparatus of the water-cooled type, specimen holders are fitted to take specimens of approximately 7 cm × 12 cm; When desired, specimens of different sizes to fit alternative sizes of specimen holder may be used. The covers shall make close contact with the surface of the unexposed areas of the specimens and the references in order to give a sharp line of demarcation between exposed and unexposed areas but shall not compress the specimen unnecessarily. All references shall be exposed on a white cardboard backing. Specimens may also be mounted on white cardboard if desired.

5.4 The specimens to be tested and the Blue Wool References shall be of equal size and shape in order to avoid errors in an assessment due to overrating the visual contrast between exposed and unexposed parts on a larger pattern as against narrower references (see 7.4).

5.5 When testing pile fabrics, the references shall be arranged in such a way that they are the same distance from the light source as the surface of the pile fabrics. This can be achieved for example by using pieces of cardboard as underlay. Note that covers for the unexposed portions shall avoid surface compression.

6 Procedure

6.1 Adjustment of the humidity conditions
(see 4.2.1.1 and 4.2.1.2)

6.1.1 Check that the apparatus is in good running order and that it is equipped with a clean xenon burner tube. (Follow the manufacturer's directions and see A.1.3, B.1.1, B.1.2, B.1.3 and B.1.4.)

6.1.2 Place a portion of the humidity test control of an a not less than 4.5 cm × 1 cm, together with the light fastn references, on to a card, if possible in the middle area of sample holder (see 5.2).

6.1.3 Place the filled specimen holders on the specimen r of the apparatus with the holders supported both top a bottom, and in proper vertical alignment. Completely fill all maining spaces in the specimen rack with holders contain white cardboard.

6.1.4 Operate the apparatus with the light on continuou until a test is completed unless the lamp requires cleaning, the burner, outer filter or inner filter requires changing becau they have reached the maximum number of hours of reco mended usage.

6.1.5 Proceed to expose the partially covered strip of t humidity test control and the references simultaneously unt contrast between the exposed and unexposed portions equal grade 4 on the grey scale is produced on the humidity test co trol.

6.1.6 Assess the light fastness of the humidity test contro this stage and, if necessary, adjust the controls on the appara to give the selected exposure conditions. Check daily and wh necessary re-adjust the controls to maintain the specified bla panel temperature and humidity (see 4.2.1.1 d) and 4.2.1.2 c

6.2 Exposure methods

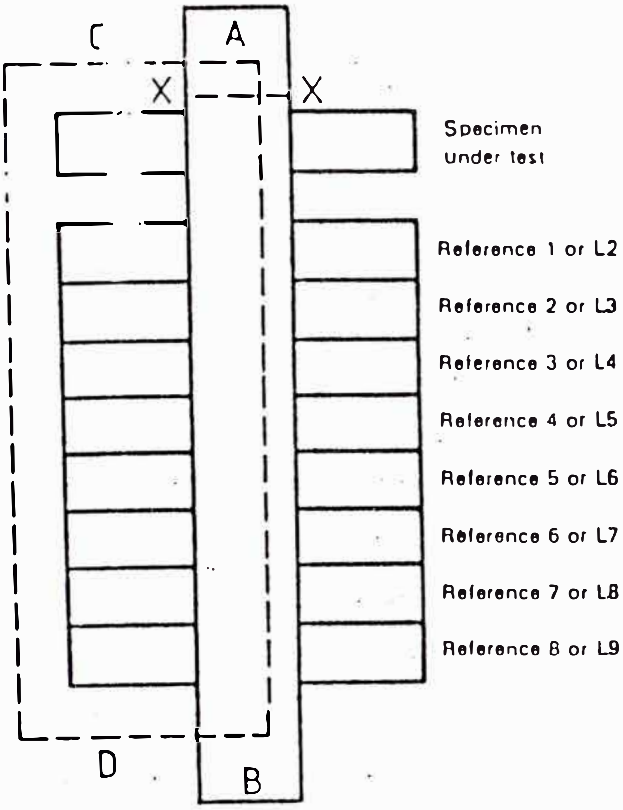
Expose the specimen (or group of specimens) and t references simultaneously, under the desired conditions. such a manner and for such a time as is necessary to evalua fully the light fastness of each specimen relative to that of t references, by progressively covering both the specimens a the exposed references during the test (either by method 1 by method 2).

6.2.1 Method 1

6.2.1.1 This method is considered most exact and should used in cases of dispute over the numerical rating. The ba feature is the control of the exposure period by inspection the *specimen* and therefore only one set of references is quired for each specimen under test.

6.2.1.2 Arrange the specimen to be tested and the referenc as shown in figure 1 with an opaque cover AB across t middle one-third of the specimen and references. Expose to t xenon arc light under the conditions enumerated in 4.2.1.1 4.2.1.2. Follow the effect of light by removing the cover and i specting the specimen frequently. When a change can perceived equal to grey scale 4-5, note the number of t references showing a similar change. (This is prelimina assessment of light fastness.) At this stage attention should given to the possibility of photochromism (see ISO 105-B05

For all specimens except for white (bleached or optica brightened) specimens, continue the procedure as described 6.2.1.3 to 6.2.1.5. For optically brightened textiles, contin with the procedure as described in 6.2.1.6.



AB: Opaque cover.
May be hinged at X-X so that it can be lifted and returned to the same place over the specimen and references.

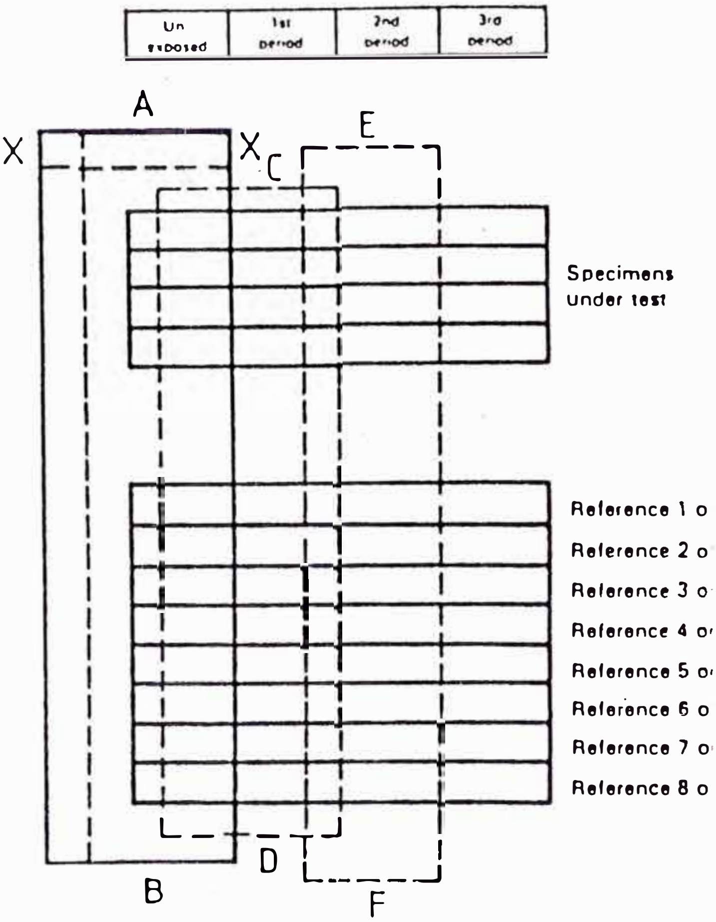
CD: Second cover.

Figure 1 — Mounting for method 1

6.2.1.3 Continue to expose until the contrast between the exposed and the unexposed portions of the specimen is equal to grey scale grade 4. Cover the left-hand one-third of the specimen and references with an additional opaque cover (CD in figure 1).

6.1.2.4 Continue to expose until the contrast between the fully exposed and unexposed portions of the specimen is equal to grey scale grade 3.

6.2.1.5 If Reference 7 or L7 fades to a contrast equal to grey scale grade 4 before the specimen does, the exposure is terminated at this stage. When a specimen has a light fastness equal to or greater than 7 or L7, it would require unduly long exposure to produce a contrast equal to grey scale grade 3; moreover, this contrast would be impossible to obtain when the light fastness is 8 or L8. Assessments in the region of 7-8 or L7-L8 are made, therefore, when the contrast produced on Reference 7 or L7 is equal to grey scale 4, the time required to produce this contrast being long enough to eliminate any error which might result from inadequate exposure.



AB: Opaque cover.
May be hinged at X-X so that it can be lifted and returned t same place over the specimen and references.

CD: Second cover.

EF: Third cover.

Figure 2 — Mounting for method 2

6.2.1.6 For white (bleached or optically brightened) tex continue to expose until the contrast between the exposed unexposed portions of the specimen is equal to grey s grade 4. If Reference 7 or L7 fades to a contrast equal to scale grade 4 before the specimen does, the exposure is minated at this stage. Assessments in the region of 7-8 or L are made, therefore, when the contrast produced on Refere 7 or L7 is equal to grey scale grade 4, the time required to duce this contrast being long enough to eliminate any e which might result from inadequate exposure.

6.2.2 Method 2

6.2.2.1 This method should be used when a large numbe specimens have to be tested simultanesouly. The basic fea is the control of the exposure periods by inspection o *references*, which allows a number of specimens differin light fastness to be tested against a single set of referen thus conserving supplies.

6.2.2.2 Arrange the specimens to be tested and the references as shown in figure 2 with the cover AB covering one-quarter of the total length of each specimen and reference. Expose under the conditions enumerated in 4.2.1.1 or 4.2.1.2. Follow the effect of light by lifting the cover AB periodically and inspecting the references. When a change in Reference 3 or L2 can be perceived equal to grey scale grade 4-5, inspect the specimens and rate their light fastness by comparing any change that has occurred with the changes that have occurred in References 1, 2 and 3 or L2. (This is a preliminary assessment of light fastness.) At this stage attention should be given to the possibility of photochromism (see ISO 105-B05).

6.2.2.3 Replace the cover AB in exactly the same position and continue to expose until a change in Reference 4 or L3 can be perceived equal to grey scale grade 4-5; at this point fix an additional cover, CD, in the position shown in figure 2, overlapping the first cover, AB.

6.2.2.4 Continue to expose until a change in Reference 6 or L5 can be perceived equal to grey scale 4-5, then fix the final cover, EF, in the position shown in figure 2, the other two covers remaining in position.

6.2.2.5 Expose until either

a) a contrast is produced on Reference 7 or L7 equal to the contrast illustrated by grey scale grade 4; or

b) a contrast equal to grey scale grade 3 has been produced on the most resistant specimen; or

c) for white (bleached or optically brightened) textiles, a contrast equal to grey scale grade 4 has been produced on the most resistant specimen;

NOTE — This may occur before the fading defined in 6.2.2.3 or 6.2.2.4 has taken place.

whichever occurs first.

6.2.3 Method 3

Where the test is to be used to check conformity with a performance specification, it is permissible to expose the specimens with two references only: that specified as minimum and the one below it. Continue exposure until grey scale grade 4 and grey scale grade 3 contrasts have been produced on separate areas of the minimum reference. For white (bleached or optically brightened) textiles, continue exposure until a grey scale grade 4 contrast has been produced between separate areas of the minimum reference.

6.2.4 Method 4

Where the test is to be used to check conformity with an agreed upon reference sample, it is permissible to expose the specimens with the reference sample only. Continue exposure until grey scale grade 4 and/or grey scale grade 3 contrasts have been produced on the reference sample. For white (bleached or optically brightened) textiles, continue exposure until a grey scale grade 4 contrast has been produced on the reference sample.

7 Assessment of light fastness

7.1 The final assessment in numerical ratings is based on contrasts equal to grey scale grade 4 and/or grade 3 between exposed and unexposed portions of the specimen. For white (bleached or optically brightened) textiles, the final assessment in numerical ratings is based on a contrast equal to grey scale grade 4 between exposed and unexposed portions of the specimen.

7.2 Remove all the covers, thus revealing on specimens and references two or three areas, depending on the method used, which have been exposed for different times, together with at least one area which has not been exposed to light. Compare the changes of the specimen with the relevant changes of the references under suitable illumination (see ISO 105-A01, clause 13). For white (bleached or optically brightened) textiles, the use of artificial daylight produced by a colour matching lamp (4.2.5) is recommended and is necessary in cases of dispute, unless otherwise agreed. The light fastness of the specimen is the number of the reference which shows similar changes in colour (visual contrast between exposed and unexposed parts of the specimen). If the specimen shows changes in colour which are nearer to the imaginary reference midway between any two consecutive references the intermediate rating, for example 3-4 or L2-L3, shall be given.

If different assessments are obtained at the different degrees of contrast, the light fastness of the specimen is the arithmetic mean of these expressed to the nearest half or whole grade. When three areas are being rated, take the mean of the contrasts closest to grey scale grades 4 and 3. Assessments, however, shall be confined to whole or midway ratings only. When the arithmetic mean gives a quarter or three-quarter rating, the assessment is defined as the next higher half or whole grade.

However, to avoid a misrating of the light fastness of the specimen due to its photochromism, the specimen should be allowed to condition in the dark at room temperature for 24 h before assessing the light fastness (see ISO 105-B05).

7.3 If the colour of the specimen is more fugitive than that of Reference 1 or L2, a rating of 1 or L2 is given.

7.4 Comparison of the changes in the specimen with changes in the references may be facilitated by surrounding the specimen with a mask of neutral grey colour approximately midway between the lighter chips in grades 1 and 2 (approximately Munsell N5) and surrounding the references in turn with a similar mask of equal aperture.

7.5 If the light fastness is equal to or higher than 4 or L3, preliminary assessment based on the contrast equal to grey scale grade 4-5 (see 6.2.1.2 and 6.2.2.2) becomes significant; if this preliminary assessment is 3 or lower or L2, it shall be included in the rating in brackets. For example, a rating of 6(3) or L5(L2) indicates that the specimen changes very slightly in the test when Reference 3 or L2 just begins to fade, but that on continuing the exposure the resistance to light is equal to that of Reference 6 or L5.

7.6 If the specimen is photochromic, the light fastness rating shall include a P bracketed with the rating obtained from the test for photochromism, for example 6(P3-4) (see ISO 105-B05).

7.7 The term "change in colour" includes change in hue, depth, brightness, or any combination of these characteristics of colour (see ISO 105-A02, sub-clause 2.6).

7.8 Exposures based on a performance reference (see 6.2.3) or together with an agreed upon reference sample (see 6.2.4) shall be assessed by comparison of the colour changes of the specimen and the references. If the specimen shows no greater change in colour than the performance reference or the reference sample, the light fastness shall be classified "satisfactory"; if the specimen shows a greater change in colour than the performance reference or the reference sample, the light fastness shall be classified "unsatisfactory".

8 Test report

8.1 For method 1 or 2

Report the numerical rating for the light fastness. The light fastness rating shall be expressed either

a) by the figure alone (when using the references designated 1 to 8); or

b) together with the prefix L (when using the references designated L2 to L9).

If this rating is equal to or higher than 4 or L3 and the preliminary assessment is equal to or lower than 3 or L2, report the latter figure in brackets. If the specimen is photochromic, the light fastness shall be followed by a P bracketed together with the grey scale rating.

8.2 For method 3 or 4

Report the classification "satisfactory" or "unsatisfactory" together with the performance reference or the reference sample used.

8.3 Report the apparatus used, the method and the exposure conditions.

9 Notes

9.1 If a glass or water filter is used to eliminate excess infr red radiation so as to meet the temperature conditions specifi in 4.2, frequent cleaning shall be carried out to avoid unwant filtering caused by dirt (see B.1.4).

9.2 The black panel thermometer shall consist of a me panel at least 4,5 cm × 10 cm whose temperature is measur with a thermometer or a thermocouple with its sensitive portio located in the centre of and in good contact with the panel. T side of the panel facing the light source shall be black wit reflectance of less than 5 % throughout the spectrum reachi the specimen; the side of the panel not facing the light sour shall be thermally isolated (see also B.1.5).

9.3 Effective humidity descriptions:

9.3.1 Qualitative

The combination of air and surface temperatures and relative humidity which governs the moisture content of t surface of the specimen during exposure.

9.3.2 Quantitative

The effective humidity can be measured only by determini the light fastness of a specific humidity test control such as th described in 4.1.3. This control has been calibrated by expos It facing south in several West European locations at differe times of the year, the exposures being made together with t references in sealed vessels containing air maintained at c stant humidities between 0 and 100 %; the results did not va greatly and the mean values are shown in figure 3.

When this control was exposed under the conditions specifi in ISO 105-B01 in temperate zones, its light fastness was fou to be, on average, 5.

9.4 Pile fabrics, such as carpets, which have fibres that ma shift position, or texture which may make evaluation of sma areas difficult, shall be tested with an exposed area not les than 5 cm × 4 cm and preferably larger (see 5.4).

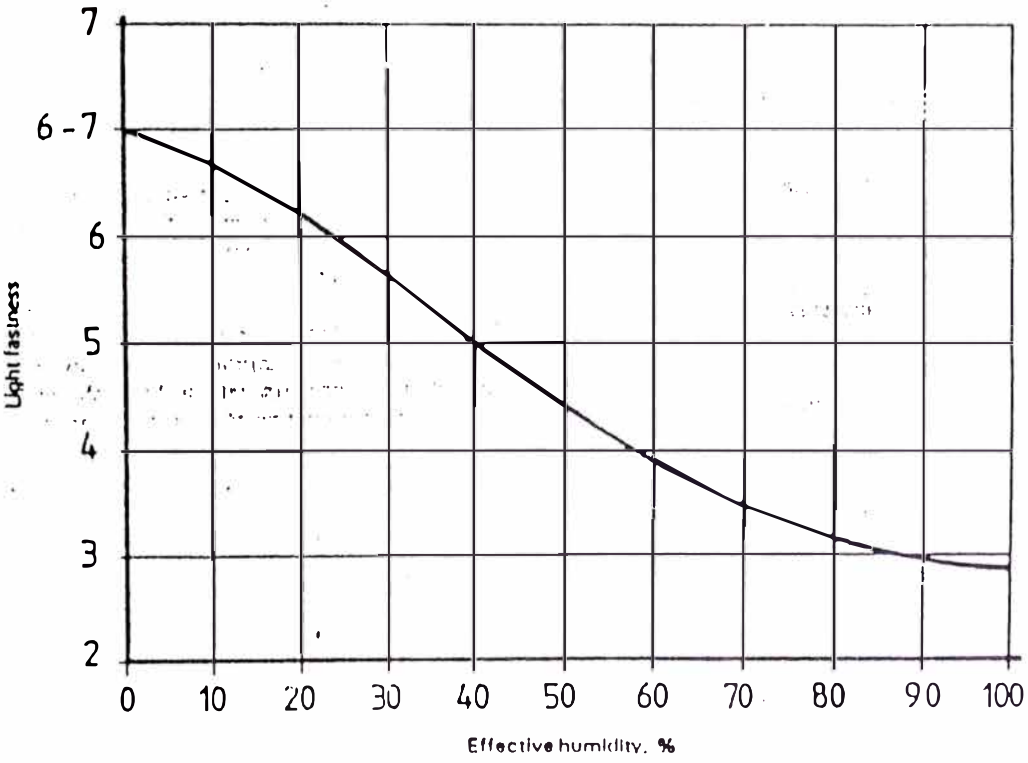


Figure 3 — Mean values obtained from exposures described in 9.3.2

Annex A

Apparatus for determining light fastness with air-cooled xenon arc lamps

(This annex forms an integral part of the standard.)

A.1 Description and conditions of use

A.1.1 The test apparatus (see also clause A.2) is equipped with an air-cooled xenon arc lamp as the source of radiation. There are two different models of the apparatus using xenon arc lamps with a wattage of 1 500 W or 4 600 W. The xenon arc lamp is surrounded by a filter system consisting of a quartz inner cylinder, an additional lamp-chimney of seven heat filters and an outer cylinder of ultra-violet special glass. With this filtering device the requirements given in 4.2.1 are satisfied.

A.1.2 The space between the xenon arc lamp and the filtering device is cooled by a current of air. This cooling air should be discharged into the open.

A.1.3 The decrease in intensity of air-cooled xenon arc lamps due to ageing is small. After 1 600 h of use, the radiation flux has dropped to approximately 90 % and replacement of the lamps is recommended.

The change in the transmission properties of the heat filter due to ageing can be eliminated almost entirely by replacing the oldest filter in rotation after 600 h.

A.1.4 Slot-in specimen holders are mounted on a revolving rack and at a given distance in circular fashion around the vertical lamp unit. The rack rotates at 5 min^{-1}. After each revolution of the rack, the sample holders are turned 180° about their longitudinal axis.

The surface area of specimen radiated at any one time is 150 cm^2 in the case of the test apparatus with a 1 500 W xenon arc lamp and 1 800 cm^2 with a 4 500 W xenon arc lamp.

A.1.5 An air current generated with a blower is directed through the test chamber and over the surface of the sample. In the case of the apparatus with a 1 600 W xenon arc lamp, the test chamber is air conditioned by adding moisture to the air via spray jets or by means of an ultrasonic humidification device, whilst, in the case of the apparatus with a 4 500 W xenon arc lamp, water is atomized very finely via an aerosol device and added to the air current. Measurement and control of the relative humidity in the test chamber is carried out either by a contact hygrometer or by electronic means.

A.1.6 The exposure conditions, relative to effective humidity, laid down in the present specifications are achieved in the test apparatus by regulating the relative humidity of the air within certain values, which are given in the instructions for using the apparatus.

The test chamber temperature and black panel temperature can be influenced by appropriately throttling the air supply. In the case of the apparatus with a 4 500 W xenon arc lamp, it is possible, by connecting to a heating and/or cooling device control the test chamber temperature over a wide range.

A.2 Description and conditions of use of an alternative system

A.2.1 Except for the changes given in A.2.2 and A.2.3, the description end conditions of use of this apparatus are similar to those given in clause A.1.

A.2.2 There are three different models of the apparatus with a wattage of 1 500 W, 2 500 W or 4 500 W. The xenon arc lamp is surrounded by a filter system consisting of an outer cylinder of ultra-violet special glass and a lamp-chimney of seven heat filters.

A.2.3 After each revolution of the rack, the sample holders are either turned 180° about their longitudinal axis or always face the xenon arc lamp for the 1 500 W type. The sample holders always face the xenon arc lamp for the 2 500 W and 4 500 W types.

Annex B

Apparatus for determining light fastness with water-cooled xenon arc lamps

(This annex forms an integral part of the standard.)

B.1 Description and conditions of use

B.1.1 The test apparatus (see also clause B.2) employed utilizes a long-arc water-cooled xenon arc lamp as the source of radiation. While all of the xenon arc lamps employed are of the same general type, different size lamps operated in different wattage ranges are employed in several sizes and types of apparatus. In each of the various models of exposure apparatus, the diameter of the specimen rack and the size and wattage of the lamp are chosen so that when the specimens are exposed in holders the irradiance at the face of the specimen is at the appropriate level.

B.1.2 The xenon arc lamp used consists of a xenon burner tube, an inner filter glass, an outer filter glass and the necessary hardware. For colour fastness tests, a borosilicate (Corning 7740) inner and soda-lime (Kimble R6) outer filter glass are used so that the irradiation at the specimen has a lower spectral cut-off at approximately that of window-glass. Other filter glasses are available with different spectral cut-offs but these should not be used for light fastness tests. Because of transmission changes (solarization), outer filter glasses should be discarded after 2 000 h of use and inner filter glasses discarded after 400 h of use. Xenon burners, because of a drop off of intensity with continued use, should be discarded when they no longer will produce adequate fading in 25 h of exposure.

B.1.3 All xenon arc exposure apparatus is equipped with suitable starters, reactance transformers and indicating and control equipment for either manually or automatically controlling the wattage of the lamp. In manually controlled units, the wattage of the lamp may require periodic adjustment to maintain adequate fading in 20 ± 5 h of operation.

B.1.4 To prevent contamination and minimize the formation of deposits on the burner tube and filter glasses, distilled or deionized water is circulated through the lamp assembly at an approximate minimum flow rate of 380 l/h, and is polished by the use of a mixed bed deionizer just ahead of the lamp. The recirculated lamp water is cooled without contaminating it by the use of a heat-exchange unit employing either tap water or refrigerant as the heat-transfer medium.

B.1.5 Accurate, close control of testing temperature, because of the sensitivity to temperature of some fabrics, is extremely important in tests made by this procedure. The temperature is measured and controlled on the basis of a black panel thermometer, which is mounted on the revolving specimen rack so that its face is in the same relative position and subjected to the same influences as the test specim The black panel thermometer consists of a 20-gauge stai steel panel 7 cm × 14,9 cm to which is mechanically fast either a stainless steel bimetallic dial-type thermometer stainless steel resistance thermometer element. The sens portion in each case is centred on the panel both from to bottom and from side to side. The face of the panel is fin with a black enamel having high absorption of light.

B.1.6 The exposure apparatus is enclosed in an insu cabinet to minimize the effects of variation temperature. A ventilating system provides a constant vol of air through the test chamber and over the test specim The temperature of the air is automatically controlled by culating warm air from the test chamber mixed with co room air. Moisture in the amount required to maintain specified relative humidity of the exit air from the test cha as measured by wet and dry bulb temperatures may be a to the air stream as it passes through the air conditio chamber in the base of the instrument.

B.1.7 A cylindrical vertical or inclined frame or rack sup ing the specimen holders is rotated at 1 min⁻¹ around lamp, which is located centrally with respect to the spec rack so that the effective arc is centred both horizontal vertically relative to the exposure area of the sample hold

B.1.8 . Apparatus for use in this method is equipped w timer unit for controlling the length of exposure Some paratus is also equipped with control equipment for turnin arc lamp on and off to produce predetermined periods of and darkness each at a controlled temperature and re humidity.

B.2 Description and conditions of use of alternative system

B.2.1 Except for the changes given in B.2.2 and B.2.3 description and conditions of use of this apparatus are si to those given in clause B.1.

B.2.2 There are two different models of the apparatus a wattage of 2 500 W or 6 000 W.

B.2.3 After each revolution of the rack, the sam[illegible] are turned 180° about their longitudinal axis.

Annex C

General information on colour fastness to light

(This annex does not form an integral part of the standard.)

When in use, textiles are usually exposed to light. Light tends to destroy colouring matters and the result is the well known defect o "fading", whereby coloured materials change colour — usually becoming paler and duller. Dyes used in the textile industry vary enormously in their resistance to light and it is obvious that there must be some method of measuring their fastness. The substrate also influences the light fastness of a dye.

This International Standard cannot satisfy completely all the interested parties (who range from dye manufacturers and the textile industry to wholesale and retail traders and the general public) without becoming technically involved and possibly difficult to understand by many who have a direct interest in its application.

The following non-technical description of the test has been prepared for the benefit of those who find the detailed technicalities of the standard difficult to understand. The method is to expose the pattern being tested and to expose also, at the same time and under the same conditions, a series of light fastness references which are pieces of wool cloth dyed with blue dyes of different degrees of fastness. When the pattern has faded sufficiently, it is compared with the references and if it has behaved, for instance, like Reference 4[1], then its light fastness is said to be 4.

The light fastness references should cover a wide range since some patterns fade noticeably after exposure for 2 or 3 h to bright summer sunshine, although others may withstand several years' exposure without change, the dyes in fact outliving the material to which they have been applied. Eight references have been chosen, Reference 1 being the most fugitive and Reference 8 the most resistant. If it takes a certain length of time for Reference 4 to fade under certain conditions, then the same amount of fading wi occur on Reference 3 in approximately half that time, or on Reference 5 in approximately twice that time, provided that the conditions are the same.

It is necessary to ensure that different people testing the same material will fade it to the same extent before assessment against the simultaneously faded reference. The ultimate users of dyed material differ widely in what they consider to be "faded articles" an therefore patterns under test are faded to two different degrees which adequately cover most opinions and make assessment more reliable. These required degrees of fading are defined by reference to a collection of reference contrasts (grey scale 5 equals no contrast, grey scale 1 equals large contrast). Thus the use of the grey scale enables fading to be taken to defined extents, and the blue wool cloths enable the light fastness to be rated.

This general principle of assessing on the basis of moderate and severe fading is complicated, however, by the fact that some patterns on exposure undergo a slight change very rapidly indeed but do not change further for a long time. These slight changes are such that under normal conditions of use they would seldom be observed, but in certain cases they become important, as the following example shows.

> Some curtain material is exposed so as to produce a moderate degree of fading and it is found that Reference 7 has faded to the same extent; the general light fastness of the fabric is therefore 7. A retailer has a length of this fabric in his window and on it is a cardboard ticket indicating the price. After a few days the ticket is removed and careful examination reveals the place where it has been resting because the surrounding cloth has changed shade slightly on exposure to light.

The important factor about this slight change is that it can only be detected when there is a sharp boundary between the exposed and unexposed areas, and these conditions rarely occur during normal use. The magnitude of this slight change would be given as an additional assessment in brackets. Thus a rating for a test could be 7(2), indicating a slight initial change equivalent to the first perceptible fade of Reference 2, but otherwise a high light fastness of 7.

A further unusual colour change is also catered for, namely photochromism. This effect is shown when a dye changes colour rapidly on exposure to strong light but on removal to a dark place the original colour returns more or less completely. The extent of photochromism is determined by the special test described in this part of ISO 105 and is shown in the rating by a number following the letter P within brackets; for example 6(P2) means a photochromic effect equal to a grey scale 2 contrast but permanent fading equal to hat of Reference 6.

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[1] The designations of the light fastness references referred to here are those of the European set (see ISO 105-B01, sub-clause 4.1.1). The principles explained are equally valid for the American set (see ISO 105-B01, sub-clause 4.1.2).

Finally, there are many patterns which change hue on prolonged exposure to light; for example, a yellow may become brown, purple may become blue. In the past there have been many arguments as to whether such patterns could be said to have faded or not. The technique used in parts B01 to B05 of ISO 105 is unambiguous on this point; it is visual contrast on exposure which is being measured, whether it be loss of colour or change in hue; in the latter case, however, the kind of change is included in the assessments. For example, consider two green patterns which, on exposure, change in appearance at the same rate as Reference 5: one becomes paler and finally white, while the other becomes first a greenish blue and finally a pure blue. The former would be rated "5" and the latter "5 bluer". In this instance also, the technique used in parts B01 to B05 of ISO 105 tries to present as complete a picture of the behaviour of a pattern on exposure as is possible without becoming excessively complicated.

AATCC Test Method 16A-1977

ANEXO 03

Colorfastness to Light: Carbon-Arc Lamp, Continuous Light

Developed in 1937 by AATCC Committee RA50; revised 1945, 1952; reaffirmed 1956; revised 1957, 1960, 1963, 1971, 1974; reaffirmed 1977.
Editorially revised 1964, 1969.

1. Purpose and Scope

(See General Method 16, Section 1.)

2. Principle

(See General Method 16, Section 2.)

3. Definitions

(See General Method 16, Section 3.)

4. Apparatus and Materials

4.1 See General Method 16, Section 4. Depending upon the method of classification being used, one or more of the following may be required.

4.2 Carbon-Arc Lamp Fading Apparatus. See Appendix A at the end of this method for details.

4.3 Light-sensitive paper and Standard Fading Strips for calibrating the lamp in "Standard Fading Hours." See Appendix B for details.

4.4 Light-sensitive Plastic Chips for calibrating the lamp in "Standard Fading Hours." See Appendix C for details.

5. Test Specimens

(See General Method 16, Section 5.)

6. Procedure

6.1 Check to be sure that the apparatus is in good running order at the start of each test or 24-hr period and is equipped with a clean globe free of chips and cracks and a new trim or set of carbons. Discard globes that are chipped or cracked or whenever pronounced discoloration develops and, in any case, after 2000 hours of use.

6.2 Prepare specimens and applicable standards as specified in General Method 16, Section 5, to a size of approximately 6.9 x 12 cm (2¾ x 4¾ in.) and mount them in the holders supplied with the apparatus. When desired, specimens of sizes to fit other specimen holders may be used. Take care to see that the front and back covers of the holders make good contact with the specimens except over the exposure area. The covers should make close contact in order to give a sharp line of demarcation between exposed and unexposed area, but should not compress the specimens unnecessarily. Other methods of mounting, e.g., on white cardboard, are sometimes used.

6.3 Place the filled specimen holders on the specimen rack of the apparatus, with the holders supported both top and bottom in proper vertical alignment. Even a small displacement of the specimen toward or away from the lamp may lead to too much or too little fading. Completely fill the specimen rack with holders containing white cardboard in all spaces not filled with specimens.

6.4 Calibrate the fading lamp apparatus during the test (see Appendix B or Appendix C).

6.5 Start the apparatus and operate it with the light on continuously until the test is completed or the carbons are consumed. Avoid unnecessary delays when the carbons must be changed and the test continued. Unnecessary interruptions and periods of standing with the light off may lead to undesirable variations in results.

6.6 Adjust the controls on the apparatus so that the black panel temperature is 63 ± 3C (145 ± 5F) when the arc lamp is being operated at the recommended amperage and arc voltage. In apparatus in which black panel temperatures are controlled by intermittent operation of the blower, the relative humidity of the air in the test chamber passing over the specimens is that produced by room air passing over wicks saturated by water. In apparatus in which black panel temperatures are controlled by continuous operation of the blower, the controls are adjusted so that the relative humidity of the air is 30 ± 5 per cent. This temperature and humidity are recommended because they have been found to produce fading rates which more generally agree with those of the sunlight method.

6.7 Examine specimens and standards after exposure for periods of 5, 10, 20, 40, 80, 160, 320 and 640 hours, or such of these periods as may be necessary to establish the period at which a color change equivalent to Step 4 of the Gray Scale is observed on the test specimen. In the two-step method, after a Step 4 color change has been observed, cover one-half of the exposed area of the test specimen and all standards and continue exposure for such of the above periods as may be necessary to establish the period at which a color change equivalent to Step 3 of the Gray Scale is observed on the test specimen. When larger exposure areas are desired, as for example in instrumental evaluation, instead of coverng a porton of the exposed area, use duplcate sets of samples and standards.

7. Evaluation

7.1 The preferred method of classification is based on AATCC Blue Wool Lightfastness Standards and/or on the AATCC Fading Units (see Test Method 16, Sections 3 and 6).

7.2 Classification Based on a Standard Sample. (See General Method 16, Section 6.)

7.3 Classification Based on a Specified Number of Standard Fading Hours.

Classify the specimen as "satisfactory" to a specified number of Standard Fading Hours if the color change is not greater than Step 4 of the Gray Scale for Color Change or alternately classify it by the equivalent step number of the Gray Scale in the specified number of Standard Fading Hours.

7.4 Classification Based on the Number of Standard Fading Hours Required to Produce a Specified Amount of Color Change.

Classify the specimen by reporting the total number of Standard Fading Hours required to produce a color change equal to that of Step 4 on the Gray Scale for Color Change.

8. Report

Include in the report the following:

(a). Classification or results.

(b). Exposure method employed.

(c). Any variation from the specified conditions.

Appendix A

A1. Carbon-Arc Lamp Fading Apparatus

A1.1 The apparatus (see A2.1) utilizes a carbon-arc lamp as the source of radiation. The arc is operated from a power supply of 208 to 250 volts. Through a suitable reactance transformer or resistance, or both, and control and regulating equipment, it is operated on AC at 15 to 17 amperes at 125 to 145 volts across the arc. The carbon electrodes (A2.2) must be the neutral solid or cored type, or both, 12.7 mm (½ in.) in diameter. The upper carbon electrode must be 30.5 cm (12 in.) long and the two lower carbon electrodes each 10.2 cm (4 in.) long. The arc must be enclosed in a heat-resistant glass bell-shaped globe (A2.3) having a lower transmission cut-off at 2750 Å with an increase in transmission to 91 percent at 3700 Å.

A1.2 A cylindrical frame between the arc and the outer enclosure of the apparatus supports specimen holders that accurately position the specimens so that they face the arc at a distance of 25.4 cm (10 in.) from the horizontal plane passing through the effective center of the arc with no part over 10.2 cm (4 in.) above or below the horizontal plane passing through the center of the arc when it is equipped with fresh carbons. The framework with specimens and holders revolves about the arc 2 ± 1 times a minute.

A1.3 Testing temperatures must be measured and regulated on the basis of a black panel thermometer unit, which is mounted on the specimen rack so that the face of the unit is in the same relative position and is subject to the same influences as the test specimens. The black panel thermometer unit consists of a 20-gauge stainless steel panel, 7 x 15 cm (2¾ x 5⅞ in.) to which is mechanically fastened a stainless steel bimetallic dial-type thermometer. This thermometer has a stem 4 mm (5/32 in.) in diameter with a 4.0 cm (1¾ in.) dial. The sensitive portion extending 3.8 cm (1½ in.) from the end of the stem is located in the center of the panel 6.4 cm (2½ in.) from the top and 4.8 cm (1⅞ in.) from the bottom of the panel. The face of the panel with the thermometer stem attached is finished with a baked-on black glossy enamel having good resistance to light.

A1.4 A blower unit in the base of the apparatus provides a flow of air over the test specimens and through the test chamber. Control of specimen and black panel temperatures is preferably accomplished by continuous operation of the blower with thermostatic control of the temperature of the air, but the use of room-temperature air the volume of which is thermostatically regulated by on-off operation of the blower is permissible. Where temperatures are controlled by regulating the temperature of a constant volume of air, an electrically operated atomizing unit adds moisture to the air as it passes through the conditioning chamber in the base section of the apparatus prior to its entry into the test chamber. Relative humidity in this type of apparatus is measured and controlled on the basis of wet- and dry-bulb thermometers at the point of exit of air from the test chamber.

A1.5 The type of apparatus providing control of temperature by intermittent operation of the blower may or may not also be equipped with a manually-controlled electrically-operated vaporizer unit. In apparatus either without the atomizer unit or when the atomizer unit is turned off, the relative humidity of the air in the test chamber is that which is produced by the use of room air which is cooled, filtered and humidified by passing over wicks saturated with water. In apparatus so equipped, when the atomizer is on the relative humidity of the air in the test chamber is that produced by air passing over the wicks plus moisture added by the atomizer unit. In apparatus with intermittent operation of the blower, relative humidity is measured by wet- and dry-bulb thermometers mounted in holders on the specimen rack so that their sensitive portion is in the same relative position as the face of the test specimens but shielded from the light.

A1.6 All types of apparatus must be equipped for measuring and regulating arc current, arc voltage, black panel temperature and exposure time. Apparatus for use in Method 16D must also be additionally equipped with an electrically-operated atomizing unit and control equipment for automatically turning the arc lamp on and off to produce predetermined cycles of light and darkness.

A2. Notes

A2.1 Available from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, Ill. 60613. The Model FDA-R Fade-Ometer with intermittent blower operation but not equipped with an atomizer unit meets the requirements of Method 16A only. The Model FDA-RC Fade-Ometer with intermittent blower operation, an atomizer unit and cycle control, and the Models 18-F, 18-FT and 18-FR Fade-Ometers or equivalent model Weather-Ometers with continuous blower operation, manual or automatic humidity control and cycle control meet the requirements of either Method 16A or 16D.

A2.2 No. 70 Solid Carbon Electrodes and No. 20 Cored Carbon Electrodes (A2.1) or equivalent, meet the requirements for use in this apparatus. On 50 and 60 cycle AC, a combination of solid and cored electrodes is employed. On 25 and 40 cycle AC both upper and lower carbon electrodes are cored and on DC both upper and lower are of the solid type.

A2.3 No. 9200—PX Borosilicate Globe or equivalent (A2.1).

Appendix B

B1. Calibration of Fading Lamp with Light-Sensitive Paper

B1.1 Light-sensitive paper and a booklet of standard faded strips of it for calibration of commercial fading machines are obtained from Office of Standard Reference Materials, National Bureau of Standards, Washington, D. C. 20234, Attention: Standard Reference Materials Unit (see B5.1, B5.2). The Standard Fading Strips in the booklet are produced in the Bureau's Master Fading Unit and are in stated intervals of Standard Fading Hours which are suitable for use in calibrating fading lamps in a length of run equivalent to that of the life of a trim of carbon electrodes.

B2. Procedure

B2.1 The paper may be used to check the performance of lamps from time to time in order to predict the number of clock hours of exposure which will be required to produce fading corresponding to a specified number of Standard Fading Hours. The more frequently such checks are made, the greater will be the assurance that the lamp is performing as desired.

B2.2 The procedure follows: Mount a piece of the paper in a specimen holder of the lamp in the usual way (without backing), and place it in the apparatus at the time it is started with a new set of carbons. Expose the paper continuously for 20 hours. Remove it and allow it to stand in the dark at room temperature for at least 2 hours in order for it to cool and to regain its normal moisture from the air. Trim off and discard the unexposed edges, as they may affect the judgment of the fading.

B2.3 Compare the fading of the exposed paper with that of the standard faded strips in the booklet. To do this, allow the pages to flip open one after another, rear cover first, and slip the exposed paper under one standard faded strip after another, being careful to have the standard strip superimposed closely upon the exposed paper, and the grain, that is, the long dimension or "machine" direction of the two, in the same direction. Make the comparison in the light from a daylight fluorescent lamp or equivalent source with illumination of 538 lux (50 foot candles) or more on the papers. The lamp should be parallel with the long edge of the paper and booklet. The incident light should be at an angle of 45°, and the line of sight perpendicular to the surface of the paper. Avoid touching the surfaces of the exposed paper and the standard strips with the fingers, as they are sensitive to moisture and soil easily.

B2.4 From the comparison, estimate the exposure in Standard Fading Hours which would duplicate the fading of the test piece. Obtain a factor for converting clock hours of exposure in the lamp to Standard Fading Hours. For example, if the paper exposed for 20 clock hours faded to an extent considered to fall half-way between the 16 and 20 SFH strips in the booklet, i.e., 18 SFH, the factor would be 18/20 or 0.9. Credit textiles exposed in the machine for a given number of clock hours with an exposure in Standard Fading Hours of 0.9 times the clock hours.

B2.5 The recommended fading rate is 18 ± 2 SFH in 20 clock hours and if the factor is greater than 1.0 the fading rate is considered too high and if below 0.8 too low (see B5.3). The lamp should then be adjusted to fall within the recommended range.

B3. Use of Paper in Testing

B3.1 The lamp calibration outlined in the preceding paragraphs is a suitable basis for timing exposures in routine testing. For more important testing, however, the dosage of radiant energy should be measured with the paper during each test, as the fading rate of a lamp may change from day to day and even during a test. The procedure is illustrated by the following directions for control of a 20-hour exposure. For long exposures, a succession of papers will have to be used and the number of Standard Fading Hours shown by them added together to obtain the total exposure. In carrying out such tests the paper should be changed with each change of carbons.

B3.2 Place the textile specimen and two (or more if desired) pieces of the paper in the lamp at the same time, side by side. Remove one of the papers from the lamp about 4 hours before the estimated end of the test, noting the time. Allow this paper to stand in the dark at room temperature for 2 hours, compare the fading with that of the standard faded strips, and obtain the factor for converting clock hours to SFH as already outlined. Use this factor in calculating the time of exposure for the textile under test. The piece of paper left in the lamp with the textile will have received the same radiant-energy exposure as the textile at the end of the test. The actual exposure in SFH at the end of the test will then be obtained by rating the fading of this paper with the standard faded strips in the booklet. The result can be used as evidence that the test was as desired, or sufficiently near to it, or that the test must be repeated.

B3.3 In all cases the light-sensitive paper and the book of faded standards must be from the same lot of paper as there is some variation from one lot of paper to another. Both the light-sensitive paper and the book of standards are marked with the paper lot number.

B4. Reflectance of Faded Papers

B4.1 Although the paper and booklets are designed for simple visual estimation of the fading photometric measurements may be used instead of visual estimation when desired. Photometric measurements are used regularly at the National Bureau of Standards in evaluating the faded strips that go into the booklets (B5.4, B5.5). Supplied with the paper are NBS Miscellaneous Publication 260-15, "Recommended Method of Use of Standard Light-Sensitive Paper for Use in Testing Textiles for Colorfastness to Light," and a curve and table of CIE tristimulus luminous reflectance factor against SFH. Both the booklets of faded strips and the curve supplied are identified with the lot number of the light sensitive paper for which they are applicable and can be used only with that specific lot of paper.

B5. Notes

B5.1 Launer, H. F., Light-sensitive Papers as Controls for Testing Textile Colorfastness and Stability of Materials Under Arc Lamp Exposure, *J. Research N.B.S. 41*, 169 (1948).

B5.2 For procurement, address requests for prices and orders to: Office of Standard Reference Materials, National Bureau of Standards, Washington, D. C. 20234, Attention: Standard Reference Materials Unit. The current lot is identified by the Bureau as 700b Light-Sensitive Paper and 701b Booklet of Standard Faded Strips.

B5.3 The recommended fading rate of 18 ± 2 SFH in 20 clock hours is typical of machines when exposures are made at a black panel temperature of 63 ± 3C (145 ± 5F) and is lower than the previously recommended rate which was established when black panel temperatures up to 74C (165F) were permitted.

B5.4 Hunter, R. S. Photoelectric Color Difference Meter. *Journal of the Optical Society of America*, Vol. 48, 1958, p985.

B5.5 Nimiroff, I. Colorimetry. National Bureau of Standards Monograph 104, Jan. 1968. Obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

Appendix C

C1. Calibration of Fading Lamp with Light-Sensitive Plastic Chips

C1.1 Light-sensitive yellow plastic chips with a calibration curve of change in transmittance versus Standard Fading Hours are obtained from the Office of Standard Reference Materials, National Bureau of Standards, Washington, D. C. 20234, Attention: Standard Reference Materials Unit (C.3.1).

C1.2 There are two plastic chip standards: one 1.524 mm (0.060 in.) thick for single-cycle calibration or exposures up to approximately 150 SFH, the second 3.1496 mm (0.124 in.) thick for integrating total radiant flux density during the full exposure period up to a total of approximately 250 SFH. Each lot of the yellow plastic has a specific transmittance curve, the slope of which conforms to that of the applicable standard curve obtained in the Master Lamp. The change in transmittance in the plastic chip exposed for a given period of time in the fading machine will, when referred to the calibration curve, provide a measure of the number of SFH of exposure realized.

C2. Procedure

C2.1 Prepare the yellow plastic standard by breaking the 5.1 x 10.2 cm (2 x 4 in.) molded specimen in half along the center depression. Retain one-half of chip for transmittance measurement of original.

C2.2 Mount the other yellow plastic standard in the lower position of the applicable metal frame supplied by the manufacturer of the fading apparatus. The area directly back of the yellow plastic standard must be open and not backed by any type of material.

C2.3 Expose the yellow plastic standard along with the test specimens for such periods of time as are specified in paragraph 6.7 or until the change in transmittance approaches that of the maximum number of SFH shown on the applicable curve for that thickness of the plastic standard.

C2.4 Remove the exposed specimens and plastic standard from the apparatus and allow them to lie in the dark at room temperature for at least 2 hours. Measure the transmittance of the exposed plastic standard and from the curve supplied determine the number of Standard Fading Hours obtained. (Appendix III, Method 111A, pB-161)

C2.5 Continue exposure of the plastic standard and textile samples for such additional periods of time as are specified in paragraph 6.7 or until the change in transmission approaches that of the maximum number of SFH shown on the applicable curve for that thickness of the plastic standard.

C2.6 For exposures exceeding the number of SFH shown on the applicable curve for the thickness of the plastic standard being used, addition
plates, as necessary, are used.

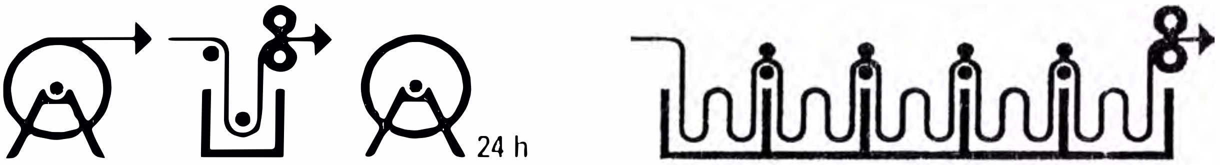
C3 Notes

C3.1 For procurement address reques
for prices and orders to: Office of Stan
ard Reference Materials, National B
reau of Standards, Washington, D.
20234, Attention: Standard Referen
Materials Unit. These are identified
the Bureau as: 702 Light-Sensitive Pla
tic Chips (0.124 in.) and 703 Ligh
Sensitive Plastic Chips (0.060 in.).

ANEXO 04

Drimarén CL

Procedimiento Pad Batch en frío



Drimarén CL	g/l	< 10	10-30	30-50	50-80
Silicato de sódio 38/40° Bé	ml/l	50	50	50	50
NaOH 36° Bé	ml/l	2.5 - 5	5 - 9	9 - 11	11 - 13
Tiempo de fijación	min	24 h	24 h	24 h	24 h
Silicato de sódio 43/45° Bé	ml/l	41	41	41	41
NaOH 36° Bé	ml/l	1.5 - 4	4 - 8	8 - 10	10 - 12
Tiempo de fijación	min	24 h	24 h	24 h	24 h
Silicato de sódio 48/50° Bé	ml/l	37	37	37	37
NaOH 36° Bé	ml/l	0 - 1	1 - 5	5 - 7	7 - 9
Tiempo de fijación	min	24 h	24 h	24 h	24 h

Propiedades de solideces:

	Amarillo CL			Rojo CL			Azul CL			Azul marino CL		
Intensidad Standard	1/25	1/3	1/1	1/25	1/3	1/1	1/25	1/3	1/1	1/25	1/3	1/1
Luz de Xenón ISO B02 Luz en húmedo ISO 105/B04, 15h	4-5 4-5	4-5 5	4-5 5	3 4-5	3-4 4-5	3-4 4-5	5-6 4-5	6 4-5	7 4-5	3 3-4	3 3-4	3-4 3-4
	Intensidad Standard, 1/1											
	N	Co	CV Wo	N	Co	CV Wo	N	Co	CV Wo	N	Co	CV Wo
Lavado doméstico ISO 105/C06/C2S, 60°C	4-5	4-5	4-5 -	4-5	5	4-5 -	5	5	5 -	5	4-5	4-5 -
Lavado doméstico M&S C4A, 60 °C	4-5	5	- 5	4-5	5	- 5	5	5	- 5	4-5	5	- 5
Lavado AATCC IIA 49°C	4-5	5	- 5	4-5	4-5	- 5	4-5	4-5	- 5	4-5	4-5	4-5 -
Lavado UK según : COX resp. C08, 60°C 12 g/l Per + 1.8 g/l TAED	4-5			4-5			4-5			3-4		
Sudor ISO 105/E04 acido álcalino	 4-5 5	 5 5	 - 5 - 5	 4-5 4	 4 4	 - 4 - 4-5	 4-5 5	 5 5	 - 5 - 5	 4-5 4-5	 4-5 5	 - 5 - 4-5
Sudor M&S C7 acido álcalino	 5 4	 5 5	 - 5 - 5	 4-5 4	 4-5 4	 - 4-5 - 4-5	 5 5	 5 5	 - 5 - 5	 4 4-5	 4-5 4-5	 - 5 - 5
Sudor AATCC 15 acido	4-5	5	- 5	4-5	4-5	- 4	4-5	5	- 5	4-5	5	- 5
Mercerizado ISO 105/X04	5	5	- -	4-5	4-5	- -	5	4-5	- -	4-5	4	- -
Agua clorada ISO 105/E03 cloro activo: 20 mg/l	4			4			3			2-3		

ANEXO 05

C06:
Colour fastness to domestic and commercial laundering

0 Introduction

The test methods in this part of ISO 105 are intended to reflect the effect of comprehensive laundering by either domestic or commercial procedures, as distinct from the washing test methods given in ISO 105-C01 to C05.

1 Scope and field of application

1.1 This part of ISO 105 specifies methods intended for determining the resistance of the colour of textiles of all kinds and in all forms to domestic or commercial laundering procedures used for normal household articles. Industrial and hospital articles may be subjected to special laundering procedures which may be more severe in some respects.

1.2 The colour loss and staining resulting from desorption and/or abrasive action in one "S" (single) test closely approximates to one commercial or domestic laundering. The results of one "M" (multiple) test may in some cases be approximated by the results of up to five domestic or commercial launderings at temperatures not exceeding 70 °C. The "M" tests are more severe then the "S" tests because of an increase in mechanical action.

1.3 These methods do not reflect the effect of optical brighteners present in commercial washing products.

2 References

ISO 105, *Textiles — Tests for colour fastness*

Part A01: General principles of testing.

Part A02: Grey scale for assessing change in colour.

Part A03: Grey scale for assessing staining.

Part F01: Specification for reference adjacent fabric: Woo

Part F02: Specification for reference adjacent fabric: Cotton and viscose.

Part F03: Specification for reference adjacent fabric Polyamide.

Part F04: Specification for reference adjacent fabric Polyester.

Part F05: Specification for reference adjacent fabric Acrylic.

Part F06: Specification for reference adjacent fabric: Silk

Part F07: Specification for reference adjacent fabric Secondary acetate.

Part F08: Specification for reference adjacent fabric Triacetate.

Part F10: Specification for reference adjacent fabric: Mult fibre.

3 Principle

A specimen of the textile in contact with specified adjacen fabric or fabrics is laundered, rinsed and dried. Specimens a laundered under appropriate conditions of temperatur alkalinity, bleaching and abrasive action such that the result obtained in a conveniently short time. The abrasive action is a complished by the use of a low liquor ratio and an appropria number of steel balls. The change in colour of the specime and the staining of the adjacent fabric or fabrics are assesse with the grey scales.

4 Apparatus and reagents

4.1 Suitable mechanical device (see 8.1), consisting of water bath containing a rotatable shaft which supports radiall stainless steel containers (75 ± 5 mm diameter × 125 ± 10 m high) of capacity 550 ± 50 ml, the bottom of the containe being 45 ± 10 mm from the centre of the shaft.

The shaft/container assembly is rotated at a frequency of 40 ± 2 min^{-1}. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature ± 2 °C.

4.2 **Non-corrodible (stainless) steel balls**, approximately 0,6 cm in diameter.

4.3 **Adjacent fabrics**.

Either :

4.3.1 **A multifibre adjacent fabric**, complying with ISO 105-F10, according to the temperature used:

— a multifibre adjacent fabric (DW) containing wool and acetate (tests at 40 °C and 50 °C and in certain cases — see note — also at 60 °C);

NOTE — These cases should be indicated in the test report (see 7a)).

— a multifibre adjacent fabric (TV) not containing wool and acetate (in certain tests at 60 °C, and in all tests at 70 °C and 95 °C).

Or:

4.3.2 **Two single-fibre adjacent fabrics**, one of the same fibre (or the predominant fibre in the case of blends) as the fabric under test and the second made of the fibre specified in table 1 or as otherwise specified.

Table 1 — Pairs of adjacent fabrics

If first piece is:	Second piece to be:	
	For tests A and B	For tests C, D and E
cotton	wool	viscose
wool	cotton	—
silk	cotton	—
viscose	wool	cotton
linen	wool	viscose
acetate and triacetate	viscose	viscose
polyamide	wool or cotton	cotton
polyester	wool or cotton	cotton
acrylic	wool or cotton	cotton

4.3.3 If required, a **non-dyeable fabric** (e.g. polypropylene).

4.4 **Detergent**, without optical brightener (see 8.2).

4.5 If required, **sodium carbonate** (Na_2CO_3).

4.6 **Sodium hypochlorite or lithium hypochlorite** (see 8.3).

4.7 If required, **sodium perborate tetrahydrate** ($NaBO_3.4H_2O$).

4.8 **Distilled water** (see 8.4).

4.9 **Grey scales** for assessing change in colour and staining (see clause 2).

4.10 If required for pressing treatment, **flat-iron**, of mas exceeding 2,5 kg and capable of giving the temperature cated in 6.9 b).

4.11 If required for souring treatment, **acetic acid** solu containing 0,2 g of glacial acetic acid per litre.

5 Test specimen

5.1 If the textile to be tested is fabric, either:

a) attach a specimen 10 cm × 4 cm to a piece of multifibre adjacent fabric (4.3.1), also 10 cm × 4 cm sewing along one of the shorter edges, with the multi adjacent fabric next to the face side of the specimen,

b) attach a specimen 10 cm × 4 cm between the single-fibre adjacent fabrics (4.3.2) by sewing along on the shorter edges.

5.2 Yarn may be knitted into fabric and tested in this fc Where yarns or loose fibres are to be tested, take a mass of yarn or loose fibre approximately equal to one-half of the c bined mass of the adjacent fabrics and either:

a) place it between a 10 cm × 4 cm piece of the multif fabric (4.3.1) and a 10 cm × 4 cm piece of the non-dye fabric (4.3.3) and sew them along all four sides (see clause 8.6 of ISO 105-A01), or

b) place it between 10 cm × 4 cm pieces of the specified single-fibre fabrics (4.3.2) and sew them alon four sides.

6 Test procedures

6.1 Prepare the wash liquor by dissolving 4 g of detergent litre of distilled water (see 8.4). For all C, D or E tests, adjust pH as stated in table 2 by the addition of approximately 1 g sodium carbonate per litre of solution. The liquor should cooled to 20 °C before the pH is measured. For the A an tests, no adjustment of pH is required.

6.2 For tests where perborate is employed, prepare washing solution containing perborate at the time of use heating the liquor to a maximum temperature of 60 °C for more than 30 min.

6.3 For tests D3S and D3M, add to the wash liquor suffici sodium hypochlorite solution or lithium hypochlorite solution provide the concentration of available chlorine specified table 2.

6.4 Add to each container the volume of wash lio specified in table 2. Except for tests D2S and E2S, adjust temperature of the liquor to withi ± 2 °C of the specifi temperature and then place in the container the specim

Table 2 — Test conditions

Test No.	Temperature °C	Liquor volume ml	Available chlorine %	Sodium perborate g/l	Time min	Steel balls	Adjust
A1S	40	150	None	None	30	10*	Not adjuste
A1M	40	150	None	None	45	10	Not adjuste
A2S	40	150	None	1	30	10*	Not adjuste
B1S	50	150	None	None	30	25*	Not adjuste
B1M	50	150	None	None	45	50	Not adjuste
B2S	50	150	None	1	30	25*	Not adjuste
C1S	60	50	None	None	30	25	10.5 ±
C1M	60	50	None	None	45	50	10.5 ±
C2S	60	50	None	1	30	25	10.5 ±
D1S	70	50	None	None	30	25	10.5 ±
D1M	70	50	None	None	45	100	10.5 ±
D2S	70	50	None	1	30	25	10.5 ±
D3S	70	50	0.015	None	30	25	10.5 ±
D3M	70	50	0.015	None	45	100	10.5 ±
E1S	95	50	None	None	30	25	10.5 ±
E2S	95	50	None	1	30	25	10.5 ±

* For delicate fabrics and articles of wool or silk or blends containing these fibres, steel balls are not used in the test. Record the use of stee the test report (see 7c)).

together with the specified number of steel balls. Close the container and operate the machine at the temperature and for the time specified in table 2.

6.5 For tests D2S and E2S, place the specimen in the container at a temperature of approximately 60 °C, close the container and raise the temperature to within ± 2 °C of the specified temperature in not more than 10 min. Begin timing the test as soon as the container is closed. Operate the machine at the temperature and for the time specified in table 2.

6.6 For all tests, remove the composite specimen at the end of the wash and rinse twice for 1 min in two separate 100 ml portions of water at 40 °C.

6.7 In countries where the practice is to sour at the end of the washing operation, the following optional operation may be conducted.

Treat each composite specimen in a 100 ml portion of the acetic acid reagent (4.11) for 1 min at 30 °C. Then rinse each composite specimen in a 100 ml portion of water for 1 min at 30 °C.

6.8 For all methods, extract the excess water from the composite specimen.

6.9 For all methods, dry the specimen by one of the following procedures:

a) by hanging it in air at a temperature not exceeding 60 °C, with the parts in contact only at the line of stitching;

b) in countries where the practice is to dry fabrics by pressing, each specimen may be dried by pressing it with the flat-iron (4.10) at the temperature appropriate to the fabric under test, but in no case at a temperature above 150 °C, with the adjacent fabric uppermost and in contact with the face of the specimen.

6.10 Assess the change in colour of the specimen a staining of the adjacent fabric using the grey scales

7 Test report

The test report shall include the following information

a) the numerical ratings for the change in colour of specimen and for the staining of the adjacent fabric us

b) the number of the method of test used (as listed table 2);

c) whether steel balls have been used in some of the A/ B tests;

d) whether the treatment in the acetic acid reag described in 6.7 was conducted;

e) whether the specimen was air dried or dried by press as described in 6.9; if the latter, the temperature of pressing treatment shall be reported.

f) whether the AATCC Reference Detergent WOB o ECE Reference Detergent for colour fastness tes without optical brightener, was used

8 Notes

8.1 Other mechanical devices may be used for this tes vided that the results are identical with those obtained apparatus described in 4.1.

8.2 Either of two detergents may be used:

a) AATCC Reference Detergent WOB with the f properties and composition:

The detergent is low sudsing; the surfactants co the detergent are anionic with a small proportion ionic. They are biodegradable

Nominal composition :	% (*m*/*m*) (± 0,02 %)
Linear alkyl sulfonate, sodium salt (LAS)	14,00
Alcohol ethoxylate	2,30
Soap — high molecular mass	2,50
Sodium tripolyphosphate	48,00
Sodium silicate (SiO_2/Na_2O = 2/1)	9,70
Sodium sulfate	15,40
Carboxymethylcellulose (CMC)	0,25
Water	7,85
	100,00

b) In countries where perborates are used in laundering, the ECE Reference Detergent for colour fastness testing, without optical brightener, may be used.

NOTE — Information on the availability of this detergent can be obtained from national standards organizations.

The composition of the ECE Detergent is as follows:

	Composition as such % (*m*/*m*) (± 0,02 %)
Linear sodium alkyl benzene sulfonate (mean length of alkane chain C 11,5)	8,0
Ethoxylated tallow alcohol (14 EO)	2,9
Sodium soap, chain length C_{12} — C_{16} : 13 — 26 % C_{18} — C_{22} : 74 — 87 %	3,5
Sodium tripolyphosphate	43,7
Sodium silicate (SiO_2/Na_2O = 3,3/1)	7,5
Magnesium silicate	1,9
Carboxymethylcellulose (CMC)	1,2
EDTA, sodium salt	0,2
Sodium sulfate	21,2
Water	9,9
	100,0

B.3 The pH value and available chlorine content of a lar number of trade-named products of sodium hypochlor (NaOCl) vary from pH 9,8 to 12,8 and the Cl_2 content from 40 160 g/l. The actual available chlorine shall be determin before use and the following method is suggested.

Pipette a 1,00 ml portion of the stock sodium hypochlorite soluti into a conical flask and dilute to 100 ml with distilled water. A 20 ml of 294 g/l sulfuric acid (H_2SO_4) solution and 6 ml of 120 g potassium iodide (KI) solution. Titrate with standard volumetr sodium thiosulfate solution, $c(Na_2S_2O_3.5H_2O)$ = 0,1 mol/l.

The available chlorine (Cl_2) content is given, as a percentage b mass, by the formula

$$\frac{V \times c \times 0{,}035\,5}{V_0 \times \rho_0} \times 100$$

where

V_0 is the volume, in millilitres, of sodium hypochlorite solution taken;

ρ_0 is the density, in grams per millilitre, of the sodium hypochlorite solution;

V is the volume, in millilitres, of sodium thiosulfate solution used;

c is the amount-of-substance concentration, in moles per litre, of the sodium thiosulfate solution.

B.4 Distilled water or water of near-zero hardness (not over 5 ppm) shall be used to dissolve the detergent for the test solution.

A minimum volume of 1 litre of detergent solution shall be prepared because of possible lack of homogeneity of the detergent powder.

National appendix to C06

T[illegible]es [illegible] methods in this section has been produced as [illegible]ion to the well established tests for colour fast[illegible] to washing given in sections C01 to C05, in order to c[illegible] for demands for more consumer orientated tests. It is [illegible] intended to withdraw C01 to C05.

The principal criticisms of the C01 to C05 tests have been the use of soap and soda as the detergent and the absence of sodium perborate. In order to meet these criticisms a detergent for a colour fastness test has been developed, with the cooperation of the European detergent industry, which is based on a low sudsing formulation and provision has been made for the addition of sodium perborate.

In the methods there is a wide choice of washing conditions to reflect the different washing processes used throughout the world. For instance, while sodium perborate is used extensively in Europe it is not used in the USA.

In accordance with the earlier decision to adopt the methods given in ISO 105 in their entirety, this new section C06 is included in the British Standard in full, although only some of the test conditions are suitable for use in the UK. Detailed recommendations on those options in C06 that are considered to be appropriate for use in the UK are as follows.

(a) A2S, B2S, C2S, D3S and E2S are the test conditions applicable to the UK (see table 2).

(b) The 'single test' conditions for each of the tests listed in (a) are recommended. It is considered that the number of steel balls in the 'multiple test' conditions is excessive.

(c) D3S is recommended as a test for washing in the presence of sodium hypochlorite.

(d) Souring after washing (see 6.7) should be omitted since this is not relevant to UK or European domestic practice.

(e) The composite specimens should be dried by hanging in air at a temperature not exceeding 60 °C with the test specimen and adjacent fabrics in contact along one line of stitching only (see 6.9 (a)).

Ironing dry with the test specimen and adjacent fabric in contact is not recommended (see 6.9 (b)).

(f) In the case of tests C2S, D3S, D3M and E2S, the adjustment of the pH to pH 10 with sodium carbonate is not considered necessary.

(g) The recommended detergent is the ECE Reference Detergent, which has been formulated in conjunction with the UK and European detergent industry.

NOTE 1. For details of the sources of supply of a suitable detergent apply to the Enquiry Section, BSI, Linford Wood, Milton Keynes, MK14 6LE, enclosing a stamped, addressed envelope for reply.

These tests are intended for use on small test pieces. For tests on whole garments reference should be made to BS 4923.

NOTE 2. If it is desired to investigate the effect of optical brightening agents, the IEC* Reference Detergent or AATCC Reference Detergent 124 should be used.

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*International Electrotechnical Commission.

ANEXO 06

AATCC Test Method 61-1980

Colorfastness to Washing, Domestic; and Laundering, Commercial: Accelerated

Developed in 1950 by AATCC Committee RA60; revised 1952, 1954; reaffirmed 1956; revised 1957, 1960, 1961, 1970, 1972; reaffirmed 1962, 1965, 1968, 1969, 1975, 1980; editorially revised 1973, 1974, 1975, 1976. (Same as ANSI L14.81-1973)

1. Purpose and Scope

1.1 These accelerated laundering tests are designed for evaluating the washfastness of textiles which are expected to withstand frequent laundering. The color loss and abrasive action resulting from solution and/or abrasive action of five average hand, commercial, or home launderings, with or without chlorine, are closely approximated by one 45-minute test. However, the staining effect produced by five average hand, commercial, or home launderings cannot always be predicted by the 45-minute test. Staining is a function of the ratio of colored to undyed fabrics, fiber content of fabrics in the wash load and other end use conditions which are not always predictable.

2. Principle

2.1 Specimens are laundered under appropriate conditions of temperature, bleaching and abrasive action such that the desired loss of color is obtained in a conveniently short time. The abrasive action is accomplished by the use of throw, slide, and impact, together with the use of a low liquor ratio and an appropriate number of steel balls.

3. Apparatus and Materials

3.1 Launder-Ometer or similar apparatus for rotating closed containers in a thermostatically controlled water bath at 42 rpm (see 10.1).

3.2 Stainless steel cylinders (see 10.1) or glass jars (see 10.2) (500 ml) (1 pt), 7.5 x 12.5 cm (3 x 5 in) (IA test)

3.3 Stainless steel cylinders, 9 x 20 cm (3½ x 8 in.) (IIA, IIIA & IVA Tests) (see 10.1).

3.4 Adapter plates (for holding 9 x 20 cm (3½ x 8 in.) cylinders on Launder-Ometer shaft) (see 10.1).

3.5 Stainless steel balls (see 10.1).

3.6 Flatiron (see 10.3).

3.7 Multifiber test fabric No. 1 or No. 10 (see 10.4).

3.8 Cotton fabric 80 x 80, bleached, desized (see 10.4).

3.9 AATCC Standard Detergent WOB (without optical brightener) (see 10.5, 10.6).

3.10 AATCC Standard Detergent 124 (contains optical brightener) (special use—see 10.5, 10.6).

3.11 Acetic acid, 28%.

3.12 Water, distilled (see 10.7).

3.13 Sodium hypochlorite (see 10.8).

3.14 AATCC Chromatic Transference Scale (see 10.6).

3.15 Gray Scale for Color Change (see 10.6).

3.16 Gray Scale for Staining (see 10.6).

4. Test Specimens

4.1 The size of the specimens required for the various tests is as follows:

5 x 10 cm (2 x 4 in.) for IA Test
5 x 15 cm (2 x 6 in.) for IIA, IIIA and IVA Tests.

4.2 One specimen is need for each container.

4.3 To determine staining in the IA and IIA Tests multifiber test fabric should be used. To determine staining in the IIIA and IVA Tests (see 10.9) bleached cotton fabric should be used (see 10.10). With respect to the IIIA and IVA Tests, the use of multifiber test fabric is optional but the staining of acetate, nylon, silk, and wool is disregarded unless one of these fibers is present in the fabric being tested or known to be in the final garment.

4.4 Prepare pieces with a 5 cm (2 in.) square of multifiber cloth or white cotton fabric (as required) sewed or stapled along one 5 cm (2 in.) edge of the test specimen and in contact with the face of the material. When multifiber test cloth is used, attach so that each of the 6 fiber stripes along the 5 cm (2 in.) edge of the specimen. It is recommended that knitted fabrics be sewn or stapled at the four edges to equivalent size pieces of 80 x 80 bleached cotton fabric to avoid rolled edges and to assist in obtaining a uniform test result over the entire surface.

5. Procedure

5.1 Table I summarizes the conditions of the tests.

5.2 Adjust the Launder-Ometer to maintain the designated bath temperature. Prepare the required volume of wash liquor. Preheat this solution to the prescribed temperature.

5.3 The IA Test is run in pint glass jars or 7.5 x 12.5 cm (3 x 5 in.) stainless steel cylinders. The IIA, IIIA and IVA tests are run in 9 x 20 cm (3½ x 8 in.) stainless steel cylinders.

5.3.1 For the IA, IIA and IIIA tests, place in cylinder the amount of detergent solution as designated in Table I.

5.3.2 For the IVA Test, place in cylinder 45 ml of detergent solution and 5 ml of 0.15% available chlorine soluiton, buffered to a pH of 11, making a total volume of 50 ml.

5.3.3 For all the tests add the designated number of stainless steel balls to each container and clamp the cover. Fasten the 7.5 x 12.5 cm (3 x 5 in.) containers vertically and the 9 x 20 cm (3½ x 8 in.) containers horizontally in the adapters on the rotor of the Launder-Ometer in such a manner that when the containers rotate, the covers strike the water first. They are also arranged so that an equal number of containers is on each side of the shaft.

5.4 Start the rotor and run for not less than two minutes to preheat the containers.

5.5 Stop the rotor and with a row of containers in an upright position, unclamp the cover of one container, enter a well-crumpled test specimen into the solution and replace the cover, but do not clamp it. Repeat this operation until all the containers in the row have been loaded. Then clamp the covers in the same order in which the containers were loaded (cover clamping is delayed to allow equilization of pressure). Start the Launder-Ometer and run at 42 rpm for 45 minutes.

5.6 The rinsing, souring extraction, and drying methods are the same for all the tests. Stop the machine, remove the containers and empty the contents. Rinse each test specimen twice, in beakers, in fresh 100-ml baths of water at 40C (105F) for one-minute periods with occasional stirring or hand squeezing. Sour in 100 ml of a 0.014% solution of acetic acid (0.05 ml of 28% acetic acid per 100 ml of water) for one minute at 27C (80F). Rinse again for one minute in 100 ml water at 27C (80F). Hydroextract or pass the test specimens between wringer rolls to remove excess moisture. Dry by pressing with an iron (135-150C) (275-300F) (see 10.3) with the multifiber or white cotton fabric uppermost and in contact with the face of the test specimen.

6. Interpretation of Results

6.1 The conditions in these tests give results which correlate with the results of five average home or commercial launderings. These are accelerated tests, and in obtaining the required degree of acceleration some of the conditions, such as temperature, were purposely exaggerated. These tests are satisfactory consumer end-use tests, and the correlation with average laundry practice is given in the following section on Evaluation.

7. Evaluation

7.1 Test No. IA—This test is designated for evaluating the colorfastness of fabrics that are expected to withstand repeated hand washing at low temperature. Specimens subjected to this test should show color change similar to that produced by five average careful hand launderings at a temperature of 40C (105F).

7.2 Test No. IIA—This test is designated for evaluating the washfastness of fabrics that are expected to withstand repeated low-temperature machine washing in the home or in the commercial laundry. Specimens subjected to this test should show color damage similar to that produced by five commercial launderings at 38C (100F) or by five home machine launderings at medium or warm setting in the temperature range of 38C (100F).

7.3 Test No. IIIA—This test is especially designed for evaluating washfastness of fabrics considered washable under vigorous conditions. Specimens subjected to this test should show color damage similar to that produced by five commercial launderings at 49C (120F) or by five home machine launderings at 60C (140F) both without chlorine.

7.4 Test No. IVA—This test is designed for evaluating the washfastness of textiles that may be laundered in the presence of available chlorine. Specimens subjected to this test should show color damage similar to that produced by five commercial launderings at 71C (160F) with 1.9 liters (two quarts) of 1.0% available chlorine per 45.4 kg (100 lb) of load (white wash formula) or by five home machine launderings at 60 to 66C (140 to 150F) with 3.74 g per liter (0.5 oz/gal of 5.0% available chlorine per 3.6 kg (8 lb) load.

Table I

Test Conditions

Test No.	*Temp.* F	C	*Total Liquor Volume in ml.*	*% Detergent of Total Volume*	*% Available Chlorine of Total Volume*	*Steel Balls (number)*	*Time in Minutes*
IA	105	40	200	0.5	None	10	45
IIA	120	49	150	0.2	None	50	45
IIIA	160	71	50	0.2	None	100	45
IVA	160	71	50	0.2	0.015	100	45

8. Evaluation Method for Change in Color

8.1 The effect on the color of the test specimens can be expressed and defined by reference to the Gray Scale for Color Change.

Class 5—negligible or no change as shown in Gray Scale Step 5.

Class 4—a change in color equivalent to Gray Scale Step 4.

Class 3—a change in color equivalent to Gray Scale Step 3.

Class 2—a change in color equivalent to Gray Scale Step 2.

Chart 1—a change in color equivalent to Gray Scale Step 1.

9. Evaluation Method for Staining

9.1 Staining (see 10.9) can be evaluated by means of the AATCC Chromatic Transference Scale or the Gray Scale for Staining. The means should be indicated when reporting the test results.

Class 5—negligible or no staining.

Class 4—staining equivalent to Row 4 on the AATCC Scale or Step 4 on the Staining Scale.

Class 3—staining equivalent to Row 3 on the AATCC Scale or Step 3 on the Staining Scale.

Class 2—staining equivalent to Row 2 on the AATCC Scale or Step 2 on the Staining Scale.

Class 1—staining equivalent to Row 1 on the AATCC Scale or Step 1 on the Staining Scale.

9.2 Include in report whether AATCC Chromatic Transference Scale or Gray Scale for Staining was used; also whether Multifiber No. 1 or No. 10 was used.

10. Notes

10.1 Obtainable from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, Ill. 60613.

10.2 Glass jars may be used but are no longer commercially available.

10.3 A 2.268 to 2.724 kg (5 to 6 lb) iron with a 1000 watt heating unit is recommended in order to avoid large fluctuations in temperature. The temperature of the iron can be determined conveniently with the aid of a calibrated thermocouple, a thermometer inserted in a well in the iron, or alloys melting at approximately 135C and 150C (275P and 300F). It must be remembered in using the second method that there may be considerable lag between the temperature indicated by the thermometer and the actual surface temperature of the iron; and in using the second and third methods, that the iron may be cooled by contact with the cloth. Alloys of tin, lead, and bismuth in the proportions 16:25:16 and 9:8:4 melt at approximately 136C and 148C (277F and 298F) respectively. If small particles of these alloys are placed on the iron, the one alloy will melt and the other will not if the temperature of the iron is within the required range. Temperature indicators furnished as an integral part of some irons should be calibrated for accuracy. Also convenient for testing the iron temperature are Tempilstiks. These are special crayons formulated so that they will not mark on a surface which is not heated to the melting point of the crayon. Tempilstiks are available in a range of melting points from any laboratory supply house.

10.4 Obtainable from Testfabrics. Inc. P. O Drawer O, Middlesex. N. J 08846.

10.5 AATCC Standard Detergent WOB is the primary detergent to be used in this test method. Where the effect of an optical brightener may be a factor (such as in pastel pinks) the use of AATCC Standard Detergent 124 (with optical brightener) should also be made as a separate test. In either case, the detergent used must be reported with color change and staining results.

10.6 Obtainable from AATCC, P. O. Box 12215, Research Triangle Park, N. C. 27709.

10.7 Distilled water or water of approximately zero hardness (not over 5 ppm) should be used to dissolve the detergent and for the test solutions.

10.8 For determining the per cent available chlorine, pipet a 1.00 ml portion of the stock sodium hypochlorite solution into an Erlenmeyer flask and dilute to 100 ml with distilled water. Add 20 ml of 6N H_2SO_4 and six ml of 12% KI. Titrate with 0.1N sodium thiosulfate solution

Calculation:

% available chlorine

$$= \frac{\text{ml sod. thio.} \times N \times 0.0355}{1 \times \text{sp. gr. NaOCl sol'n}} \times 100$$

10.9 For staining properties, Test IIIA should be run in addition to Test IVA since the chlorine content in the latter may destroy color bleed which could cause staining in a non-chlorinated washing test such as Test IIIA. Any staining by Test IIIA should be included as part of the report of staining by Test IVA.

10.10 If multifiber is used in conjunction with Test IVA, the wool will absorb the chlorine leaving very little for bleaching action.

ANEXO 07

E04
Colour fastness to perspiration

1 Scope

This part of ISO 105 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms to the action of human perspiration.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 105. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 105 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-A03:1987, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining.*

ISO 105-F:1985, *Textiles — Tests for colour fastness — Part F: Standard adjacent fabrics.*

ISO 105-F10:1989, *Textiles — Tests for colour fastness — Part F10: Specification for adjacent fabric: Multifibre.*

3 Principle

Specimens of the textile in contact with adjacent fabrics are treated in two different solutions containing histidine, drained and placed between two plates under a specified pressure in a test device. The specimens and the adjacent fabrics are dried separately The change in colour of each specimen and the staining of the adjacent fabrics are assessed with the grey scales

4 Apparatus and reagents

4.1 **Test devices**, each consisting of a frame of stainless steel into which a weight-piece of mass 5 kg and base of 60 mm × 115 mm is closely fitted, so that a pressure of 12,5 kPa can be applied on test specimens measuring 40 mm × 100 mm placed between glass or acrylic-resin plates measuring about 60 mm × 115 mm × 1,5 mm. The test device shall be constructed so that, if the weight-piece is removed during the test, the pressure of 12,5 kPa remains unchanged (see 8 1 and 8 2)

4.2 Oven, maintained at 37 °C ± 2 °C.

4.3 **Alkaline solution**, freshly prepared, containing per litre,

0.5 g of *l*-histidine monohydrochloride monohydrate ($C_6H_9O_2N_3.HCl.H_2O$);

5 g of sodium chloride (NaCl);

either

5 g of disodium hydrogen orthophosphate dodecahydrate (Na_2HPO_4 $12H_2O$);

or

2.5 g of disodium hydrogen orthophosphate dihydrate ($Na_2HPO_4.2H_2O$).

The solution is brought to pH 8 with 0.1 mol/l sodium hydroxide solution

4.4 Acid solution, freshly prepared, containing per litre,

0.5 g of *l*-histidine monohydrochloride monohydrate ($C_6H_9O_2N_3.HCl.H_2O$);

5 g of sodium chloride (NaCl);

2.2 g of sodium dihydrogen orthophosphate dihydrate ($NaH_2PO_4.2H_2O$).

The solution is brought to pH 5.5 with 0.1 mol/l sodium hydroxide solution.

4.5 Adjacent fabrics (see ISO 105-A01:1989, subclause 8.3).

Either:

4.5.1 A multifibre adjacent fabric complying with ISO 105-F10.

Or:

4.5.2 Two single-fibre adjacent fabrics, complying with the relevant sections of F01 to F08 of ISO 105-F:1985.

One piece made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, the second piece made of the fibre as indicated in table 1 or, in the case of blends, of the kind of fibre second in order of predominance or as otherwise specified.

Table 1 — Single-fibre adjacent fabrics

If first piece is:	Second piece to be:
cotton	wool
wool	cotton
silk	cotton
linen	wool
viscose	wool
acetate	viscose
polyamide	wool or viscose
polyester	wool or cotton
acrylic	wool or cotton

4.5.3 If required, a non-dyeable fabric (for example, polypropylene).

4.6 Grey scale for assessing change in colour, complying with ISO 105-A02, and **grey scale for assessing staining**, complying with ISO 105-A03.

5 Test specimen

5.1 If the textile to be tested is fabric either

a) attach a specimen measuring 40 mm × 100 mm to a piece of the multifibre adjacent fabric, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides, with the multifibre fabric next to the face of the specimen, or

b) attach a specimen measuring 40 mm × 100 mm between the two single fibre adjacent fabrics, also measuring 40 mm × 100 mm, by sewing along one of the shorter sides.

5.2 Where yarns or loose fibre is to be tested, take a mass of the yarn or loose fibre approximately equal to one half of the combined mass of the adjacent fabrics, and either

a) place it between a 40 mm × 100 mm piece of the multifibre fabric and a 40 mm × 100 mm piece of the non-dyeable fabric and sew them along all four sides (see ISO 105-A01:1989, subclause 9.6); or

b) place it between a 40 mm × 100 mm piece of each of the two specified single-fibre fabrics and sew along all four sides.

6 Procedure

6.1 Lay out the composite specimen smooth in a flat-bottomed dish and cover with the solution. Thoroughly wet one composite specimen in the alkaline solution at pH 8 (4.3) at a liquor ratio of 50 : 1, and allow it to remain in the solution at room temperature for 30 min. Press and move it from time to time to ensure good and uniform penetration of the liquor. Pour off the solution and wipe the excess liquor off the specimen between two glass rods. Then place the composite specimen between two glass or acrylic resin plates, under a pressure of 12.5 kPa. Use separate apparatus for the acid test (4.4).

6.2 Place the test devices (4.1) each containing a composite specimen in the oven (4.2) for 4 h at 37 °C ± 2°C.

6.3 Open out each composite specimen (by breaking the stitching except on one of the shorter sides if necessary) and dry it by hanging it in air at a temperature not exceeding 60 °C, with the two or three parts in contact only at the line of stitching.

6.4 Assess the change in colour of each specimen and the staining of the adjacent fabric(s) with the grey scales (4.5)

7 Test report

The test report shall include the following particulars:

a) the number and date of this part of ISO 105, i.e. ISO 105-E04:1989;

b) all details necessary for the identification of the sample tested;

c) the numerical ratings for change in colour of the specimen in each solution;

d) if single-fibre adjacent fabrics were used, the numerical rating for staining of each kind of adjacent fabric used;

e) if a multifibre adjacent fabric was used, the staining of each type of fibre in the multifibre adjacent fabric, and the type of multifibre adjacent fabric used.

8 Notes

8.1 If the dimensions of the composite specim differ from the size of 40 mm × 100 mm, a weigh piece shall be used such that a pressure of 12,5 kP is applied to the specimen.

8.2 Other devices may be used provided that th same results are obtained as with the apparatu described above.

8.3 In many cases of cellulosic fibres dyed wi direct dyes containing copper, or after treatme with copper salts, the prescribed tests and natur perspiration bring about a removal of copper fro the dyeings. This may cause a significant alteratio in fastness to light and washing, and it is therefor recommended that this possibility be taken in consideration.

ANEXO 08

AATCC Test Method 15-1979

Colorfastness to Perspiration

Developed in 1949 by AATCC Committee RA52; revised 1952, 1957, 1960, 1962, 1972, 1975, 1976; reaffirmed 1967, 1979.

1. Purpose and Scope

1.1 This method is intended for use in determining the fastness of colored textiles to the effects of perspiration. It is applicable to dyed, printed or otherwise colored textile fibers, yarns and fabrics of all kinds and to the testing of dyestuffs as applied to textiles.

1.2 This is a performance test. Recent work by Committee RA52 showed this test will correlate with limited field studies. Background information on the committee's work and decision to eliminate the alkaline test was published in two articles in *Textile Chemist and Colorist:* "Colorfastness to Perspiration and Chemicals" (October 1974) and "Evaluating Colorfastness to Perspiration: Laboratory Test vs Wear Test" (November 1974).

1.3 Although the alkaline test has been eliminated from this method, there may be certain instances in foreign trade or special end-uses that require the alkaline test. In these instances the alkaline test should be run as in AATCC Test Method 15-1973. For convenient reference the composition of the alkaline solution is given in note 9.7.

2. Principle

2.1 A specimen of colored textile is wet out in simulated perspiration solution, subjected to a fixed mechanical pressure and allowed to dry slowly at a slightly elevated temperature.

3. Apparatus and Materials

3.1 AATCC Perspiration Tester, Perspirometer or equivalent device (plastic or glass plates are available with the equipment) (see 9.1).

3.2 Drying oven—Convection.

3.3 Multifiber test fabric No. 10 (see 9.2).

3.4 AATCC Chromatic Transference Scale or Gray Scale for Staining (see 9.3).

3.5 Gray Scale for Color Change (see 9.3).

3.6 Wringer (see 9.4).

4. Acid Solution

10 g sodium chloride
g lactic acid, USP 85%
g disodium hydrogen phosphate, anhyd. (Na_2HPO_4)
0.25 g histidine monohydrochloride (see 9.5)

Make up to one liter with distilled water.

The pH of this solution should be 4.3 ± 0.2 as established by use of an accurate pH meter. The use of pH test paper is not recommended for this purpose because of its lack of accuracy. Should the pH of the prepared acid solutions be outside the range of 4.1 to 4.5, discard this solution and prepare a new one making sure that all ingredients are weighed precisely.

5. Test Specimen

5.1 Cut a specimen 5.7 x 5.7 cm 2¼x2¼ in. of the dyed material. Sew or lay an equal size piece of No 10 multifiber test fabric to each specimen. If the fiber or fibers in the dyed fabric are not present in the multifiber test fabric, also include a piece of undyed original material in the test.

5.2 In order to maintain equal pressure on both the undyed material and the multifiber test fabric, sew or lay them into a sandwich type sample with the dyed material in the middle. Use only unfused multifiber test fabrics. Fused multifiber test fabric may have thickness variations around edges which would cause uneven compression during testing.

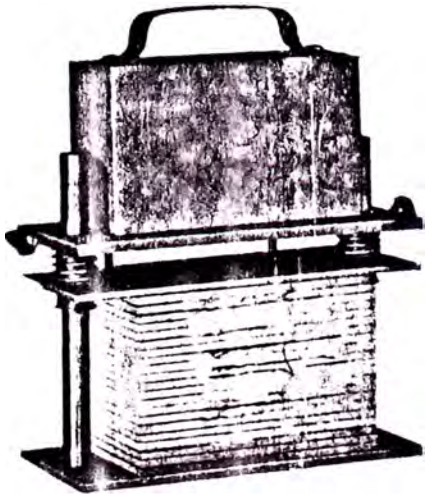

Fig. 1—AATCC Perspiration Tester.

6. Procedure

6.1 Immerse the test specimen in the required freshly prepared solution (no older than three days, see 9.8) for 15 to 30 min, with occasional agitation and squeezing to insure complete wetting. For fabrics hard to wet out, the dyed test specimen and undyed test cloth swatch(es) should be given a sufficient number of alternate wettings in the test solution and passes through a wringer to obtain complete penetration.

6.2 Once the specimen is thoroughly wet out, set the wringer for a final passage whereby the specimen will weigh 2 to 2½ times its original dry weight. The wet out, dyed fabric, backed on one side with the multifiber test fabric of the same size, and, if necessary, the undyed fabric of the original material on the other side should be passed through the wringer together. It is this combination of fabrics that should weigh 2 to 2½ times their original dry weight. Since certain fabrics may not be able to retain this amount of solution when passing through a wringer, such fabrics may be tested after blotting to the required wet pickup with a paper towel. In order to obtain true and consistent results all specimens of a given construction in a test series should have identical pickup, as the degree of staining increases with the amount of retained solution.

6.3 Place the test specimen between the plates and insert in the specimen unit in such a way that the stripes of the multifiber test fabric are in a vertical position when placed in the oven.

6.4 Depending upon equipment available, use the following alternates:

6.4.1 AATCC Perspiration Tester: Put all 21 plates into the unit regardless of the number of specimens. After the final plate is put in position (on top) set the dual plates with compensating springs in position. Place the 3.6288 kg (8 lb) weight on top making a total of 4.536 kg (10 lb) under the pressure plate, and lock the pressure plate in position by turning the thumb screws. Remove the weight and place the unit in the oven.

6.4.2 Perspirometer: The plates are held in a vertical position between an indicating scale with a fixed metal plate at one end and an adjustable metal plate at the other end. By means of adjusting screws, the mov-

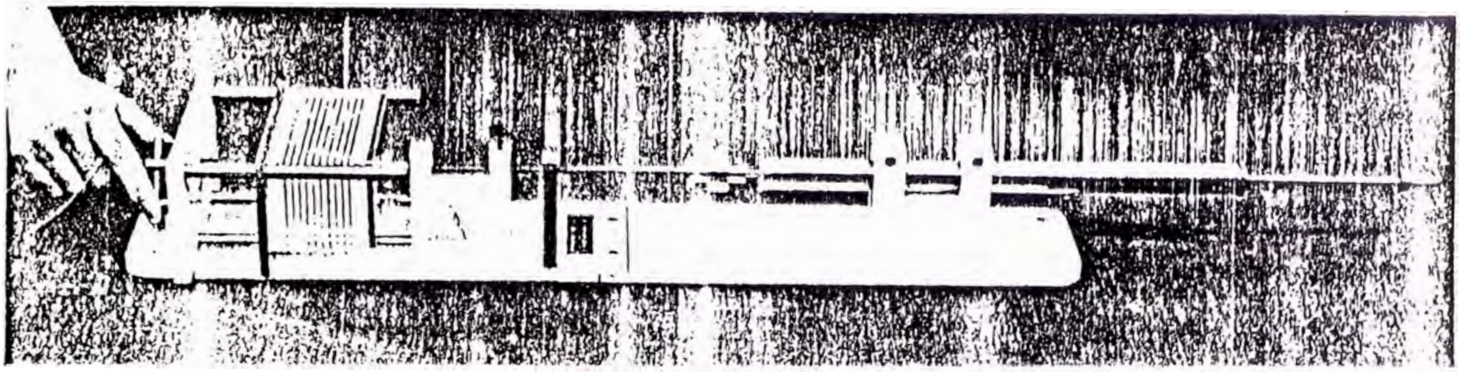

Fig. 2—Perspirometer

able plate may be made to exert increasing pressure against the test specimens. When 4.536 kg (10 lb) pressure is indicated on the scale, lock the specimen unit containing the test specimens by a set screw. The specimen unit can now be removed from the section applying the pressure and placed in the oven. Another specimen unit may be added to the pressure section and the loading procedure repeated.

6.5 Heat the loaded specimen unit in an oven at 38 ± 1C (100 ± 2F) for at least 6 hours. If not completely dry at end of the test period, the specimens should be removed from the test unit and air dried by any convenient means, not over 60C (140F). For convenience the test may be run overnight for as much as 16 hours. Tests have shown that no appreciable change in shade or staining takes place after 6 hours.

7. Evaluation

7.1 General—Unsatisfactory perspiration fastness may be due to bleeding or migration of color or it may be due to change in color of the dyed material. It should be noted that objectionable change in color may be encountered with no apparent bleeding. On the other hand, there may be bleeding with no apparent change in color, or there may be both bleeding and change in color.

Certain chrome browns will stand the standard test. However, these particular browns have been known to exhibit a change in shade or discoloration due apparently to accumulated perspiration which tends to react with certain drycleaning fluids of the chlorinated hydrocarbon type, thereby developing an acid condition. This particular discoloration can be duplicated by spotting with dilute hydrochloric acid (5 g/l) and drying.

7.2 Evaluation for Color Change—The effect on the color of the test specimens can be expressed and defined by reference to the Gray Scale for Color Change. (Usage of this scale is discussed in AATCC Evaluation Procedure 1.)

Class 5—Negligible or no change as shown in Gray Scale Step 5.

Class 4.5—A change in color equivalent to Gray Scale Step 4-5.

Class 4—A change in color equivalent to Gray Scale Step 4.

Class 3.5—A change in color equivalent to Gray Scale Step 3-4.

Class 3—A change in color equivalent to Gray Scale Step 3.

Class 2.5—A change in color equivalent to Gray Scale Step 2-3.

Class 2—A change in color equivalent to Gray Scale Step 2.

Class 1.5—A change in color equivalent to Gray Scale Step 1-2.

Class 1—A change in color equivalent to Gray Scale Step 1.

7.3 Evaluation Method for Staining—Staining can be evaluated by means of the AATCC Chromatic Transference Scale or the Gray Scale for staining. (Usage of these scales is discussed in AATCC Evaluation Procedures 2 and 3.)

Class 5—Negligible or no color transfer.

Class 4.5—Color transfer equivalent to Step 4-5 on the Gray Scale for Staining.

Class 4—Color transfer equivalent to Row 4 on the AATCC Chromatic Transference Scale or Step 4 on the Gray Scale for Staining.

Class 3.5—Color transfer equivalent to Step 3-4 on the Gray Scale for Staining.

Class 3—Color transfer equivalent to Row 3 on the AATCC Chromatic Transference Scale or Step 3 on the Gray Scale for Staining.

Class 2.5—Color transfer equivalent to Step 2-3 on the Gray Scale for Staining.

Class 2—Color transfer equivalent to Row 2 on the AATCC Chromatic Transference Scale or Step 2 on the Gray Scale for Staining.

Class 1.5—Color transfer equivalent to Step 1-2 on the Gray Scale for Staining.

Class 1—Color transfer equivalent to Row 1 on the AATCC Chromatic Transference Scale or Step 1 on the Gray Scale for Staining.

8. Report

8.1 Report the class number determined for color change in 7.2 and the staining class number of all six fibers in the multifiber test fabric as determined in 7.3. Also state which scale (AATCC Chromatic Transference Scale or Gray Scale for Staining) was used in the staining evaluation (see 9.6).

9. Notes

9.1 The AATCC Perspiration Tester is available from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, Ill. 60613. The Perspirometer is available from The Orange Machine and Mfg. Co., 1503 Bay Ave., Point Pleasant, N. J. 08742. Adequate plastic plates should be purchased with either unit.

9.2 Multifiber test fabrics is available from Testfabrics Inc., P. O. Drawer O, Middlesex, N. J. 08846. The six fiber test fabric #10 without fused edges should be used in this method.

9.3 AATCC Chromatic Transference Scale, Gray Scale for Staining, and Gray Scale for Color Change are available from AATCC, P. O. Box 12215, Research Triangle Park, N. C. 27709.

9.4 Suitable wringers are the Atlas Motorized Laboratory Wringer available from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, Ill. 60613 and the Kenmore Hand Wringer 3411-7327L available from Sears, Roebuck and Co.

9.5 Histidine monohydrochloride may be purchased from Fisher Scientific Co., 711 Forbes Ave., Pittsburgh, Pa. 15219 (Cat. No. 4274).

9.6 For very critical evaluations and in the case of arbitration, ratings must be based on the geometric Gray Scale for Staining.

9.7 Alkaline Solution: 10 g sodium chloride; 4 g ammonium carbonate, USP; 1 g disodium hydrogen phosphate, anhydrous (Na_2HPO_4); 0.25 g histidine monohydrochloride. Make up to one liter with distilled water. This solution should give a pH of 8.0.

9.8 Committee RA52 has established that fungi begin to grow in the acid perspiration solution and that the pH gradually rises after three days of storage under ambient room temperatures, even when kept in a stoppered solution bottle.

ANEXO 09

E03:
Colour fastness to chlorinated water (swimming-bath water)

NOTE. See national appendix.

1 Scope and field of application

This part of ISO 105 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms to the action of active chlorine in concentrations such as are used to disinfect swimming-bath water (break-point chlorination).

Three alternative test conditions are specified. The active chlorine concentrations of 50 mg/l and 100 mg/l are intended for swimwear. The active chlorine concentration of 20 mg/l is intended for accessories such as beach robes and towels.

2 References

ISO 105, *Textiles — Tests for colour fastness*

Part A01: General principles of testing.

Part A02: Grey scale for assessing change in colour.

3 Principle

A specimen of the textile is treated with a weak chlorine solution of a given concentration and dried. The change in colour of the specimen is assessed with the grey scale. Three alternative test conditions are specified.

4 Apparatus and reagents

4.1 Suitable mechanical device (see 8.4), consisting of a water bath containing a rotatable shaft which supports, radially, glass or stainless steel containers (75 ± 5 mm in diameter × 125 ± 10 mm high) of approximately 550 ± 50 ml capacity, the bottom of the containers being 45 ± 10 mm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of 40 ± 2 min $^{-1}$. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature ± 2 °C.

4.2 Sodium hypochlorite (NaOCl), solution having the following composition:

active chlorine: 40 to 160 g/l

sodium chloride (NaCl): 120 to 170 g/l

sodium hydroxide (NaOH): 20 g/l maximum

sodium carbonate (Na_2CO_3): 20 g/l maximum

iron (Fe): 0,01 g/l maximum

4.3 Sodium hypochlorite (NaOCl), solution containing 100 mg of active chlorine per litre, at pH = 7,50 ± 0,05 (see 8.1)

4.4 Sodium hypochlorite (NaOCl), solution containing 50 mg of active chlorine per litre, at pH = 7,50 ± 0,05 (see 8.2)

4.5 Sodium hypochlorite (NaOCl), solution containing 20 mg of active chlorine per litre, at pH = 7,50 ± 0,05 (see 8.3)

4.6 Potassium dihydrogen phosphate (KH_2PO_4).

4.7 Disodium hydrogen phosphate dihydrate ($Na_2HPO_4 \cdot 2H_2O$), or disodium hydrogen phosphate dodecahydrate ($Na_2HPO_4 \cdot 12H_2O$).

4.8 pH-meter, having an accuracy of 0,02 units.

4.9 Distilled water or deionized water.

4.10 Grey scale for assessing change in colour (see clause 2).

5 Test specimen

5.1 If the textile to be tested is fabric, use a specimen 10 cm × 4 cm.

5.2 If the textile to be tested is yarn, knit it into fabric and use a specimen 10 cm × 4 cm, or make a wick of parallel lengths 10 cm long and about 0,5 cm in diameter, tied near both ends

5.3 If the textile to be tested is loose fibre, comb and compress enough of it to form a sheet 10 cm × 4 cm. Determine the mass of the fibre and sew it on to a piece of polyester or polypropylene cloth to support the fibre. The liquor ratio (see 6.1) shall be based on the mass of fibre only.

6 Procedure

6.1 Each specimen shall be tested in a separate container in the mechanical device (4.1). Immerse the specimen in the sodium hypochlorite solution (4.3, 4.4 or 4.5), liquor ratio 100 : 1, ensuring that the specimen is thoroughly wetted. Close the container and agitate at 27 ± 2 °C for 1 h in darkness.

6.2 Remove the specimen from the container, squeeze or hydroextract it, and dry it by hanging it in air at room temperature in subdued light.

6.3 Assess the change in colour of the specimen with the grey scale.

7 Test report

Report the numerical rating for change in colour and the concentration of active chlorine used (see 4.3, 4.4 and 4.5).

8 Notes

8.. Preparation of a sodium hypochlorite solution containing 100 mg of active chlorine per litre

All sodium hypochlorite solutions should be prepared just prior to use. Prepare solutions as follows, using distilled or deionized water:

Solution 1: Dilute 20,0 ml sodium hypochlorite solution (4.2) to 1 litre.

Solution 2: 14,35 g KH_2PO_4 per litre.

Solution 3: 20,05 g $Na_2HPO_4 \cdot 2H_2O$ per litre, or 40,35 g $Na_2HPO_4 \cdot 12H_2O$ per litre.

To 25,0 ml of solution 1 add excess potassium iodide (KI) and hydrochloric acid (HCl), and titrate the liberated iodine with a sodium thiosulphate solution, $c(Na_2S_2O_3)$ = 0,1 mol/l, using starch as indicator.

Let the volume of sodium thiosulphate solution required be V ml.

For each litre of working solution at pH 7,50 ± 0,05, use:

$\frac{705,0}{V}$ ml solution 1

100,0 ml solution 2

500,0 ml solution 3

Dilute to 1 litre.

Before use, check the pH of the solution using the calibrated pH-meter (4.8).

If necessary, adjust the pH using either sodium hydroxide $c(NaOH)$ = 0,1 mol/l, or acetic acid, $c(CH_3COOH)$ = 0,1 mol

8.2 Preparation of a sodium hypochlorite solution containing 50 mg of active chlorine per litre

Follow the same procedure as in 8.1, except that for each litre of working solution at pH 7.50 ± 0,05 use $\frac{705,0}{2V}$ ml of solution 1.

8.3 Preparation of a sodium hypochlorite solution containing 20 mg of active chlorine per litre

Follow the same procedure as in 8.1, except that for each litre of working solution at pH 7.50 ± 0,05 use $\frac{705,0}{5V}$ ml of solution 1.

8.4 Other mechanical devices may be used for the test provided that the results are identical to those obtained with the apparatus described in 4.1.

National appendix to E03

This method includes the option of active chlorine concentrations of 20 mg/l, 50 mg/l and 100 mg/l. It is recommended that in the UK an active chlorine concentration of 100 mg/l is used for swimwear. This concentration was formerly given in section UK-TK. An active chlorine concentration of 100 mg/l provides test conditions giving results which correspond well with those found under swimming-bath conditions in the UK (see *Journal of the Society of Dyers and Colourists*, 1983, 97, 297).

ANEXO 10

X04:
Colour fastness to mercerizing

1 Scope and field of application

This part of ISO 105 specifies a method for determining the resistance of the colour of textiles to the action of concentrated solutions of sodium hydroxide used in mercerizing. The method is mainly applicable to cotton and to mixtures containing cotton.

2 References

ISO 105, *Textiles — Tests for colour fastness*

Part A01 : General principles of testing.

Part A02 : Grey scale for assessing change in colour.

Part A03 : Grey scale for assessing staining.

3 Principle

3.1 A specimen of the textile in contact with a specified adjacent fabric is treated with sodium hydroxide solution, rinsed, acidified, rinsed again and dried. The change in colour of the specimen and the staining of the adjacent fabric are assessed with the grey scales.

3.2 As completely resistant specimens may show an apparent increase in depth of colour, these cannot be rated 5 by the normal method of assessment. In such cases, therefore, only the changes in hue and brightness can be assessed using the grey scale, without consideration of the increase in depth, and such assessments should be marked with an asterisk (*). The meaning of the asterisk should be explained in a foot-note.

Examples

5* Increase in depth (not considered); no change in hue and brightness.

3-4 redder* Increase in depth (not considered): the hue became redder matching grey scale 3-4.

2 bluer, duller* : Increase in depth (not considered); the shade changed in hue and brightness corresponding to grey scale 2.

3.3 Specimens the colour of which does not increase in depth shall be assessed in the normal manner and the results shall not be marked with an asterisk.

Example

2 weaker, bluer, duller : Loss in depth (considered) and change in both hue and brightness corresponding to grey scale 2.

4 Apparatus and reagents

4.1 Cotton adjacent fabric, at least 10 cm × 10 cm, for evaluating staining.

4.2 Frame, for holding specimen (see clause 8).

4.3 Sodium hydroxide (NaOH), solution, 300 g/l.

4.4 Sulfuric acid, solution containing 5 ml of concentrated sulfuric acid (ρ 1,84 g/ml) per litre.

4.5 Acetic acid, solution containing 10 ml of glacial acetic acid per litre.

4.6 Grey scales for assessing change in colour and staining (see clause 2).

5 Test specimen

5.1 If the textile to be tested is fabric, sew a specimen measuring at least 10 cm × 10 cm to an equal sized piece of the adjacent fabric (4.1) around all four sides. Fasten this composite specimen to the frame (4.2) firmly, but without excessive tension.

5.3 If the textile to be tested is yarn or thread, wind an amount of it equal to the mass of the adjacent fabric on a rigid frame firmly, but without excessive tension with the strands close together and parallel to provide an area at least 10 cm × 10 cm. Sew an equal sized piece of the adjacent fabric (4.1) to this area along the two sides which cross the strands.

6 Procedure

6.1 Immerse the composite specimen with the coloured material uppermost in the sodium hydroxide solution (4.3) at 20 ± 2 °C for 5 min. Rinse the composite specimen in the frame by pouring on it 1 litre of water at 70 ± 2 °C over a period of 1 min and then rinsing in cold, running tap-water for 5 min.

6.2 Remove the composite specimen from the frame and immerse it in the sulfuric acid solution (4.4) or in the acetic acid solution (4.5) for 5 min, at a liquor ratio of 50 : 1. Rinse the specimen in cold, running tap-water until neutral.

6.3 Remove the stitching along three sides of the specimen (one side for yarns and threads) and dry it by hanging it in air at a temperature not exceeding 60 °C, taking care that the adjacent fabric and the coloured material are kept apart except at the remaining stitching.

6.4 If the specimen shows increased depth of colour, assess the change in hue and/or brightness only, using the appropriate grey scale (see clause 2). Assess the staining of the adjacent fabric with the appropriate grey scale (see clause 2).

6.5 If the specimen does not show increased depth of colour, assess the change as an overall contrast (see 3.3) and the staining of the adjacent fabric with the grey scales.

7 Test report

7.1 In the case of assessments in accordance with 6.4, report and mark with an asterisk any changes in hue and/or brightness of the specimen and report the numerical rating for staining of the cotton adjacent fabric.

7.2 In the case of assessments in accordance with 6.5, report the numerical rating for change in colour of the specimen and the numerical rating for staining of the cotton adjacent fabric.

8 Note

A metal frame suitable for the test would have two folding wings which can be locked in the closed position by a wingnut. Each of the two wings is an open square of about 8 cm × 8 cm. All four sides of the frame are corrugated or contain needle bars in order to hold the composite specimen firmly during the treatment. The rigid frame for yarns and threads should be a little larger than the corrugated or needle bar frame for fabrics and fit into the latter.

ANEXO 11

AATCC Test Method 8-1977

Colorfastness to Crocking: AATCC Crockmeter Method

Developed in 1936 by AATCC Committee RA38; revised 1937; reaffirmed 1945; revised 1952, 1957, 1961; editorially revised and reaffirmed 1966, 1974, 1977; revised 1969, 1972.
(Same as ANSI L14.72-1973)

1. Purpose and Scope

1.1 This test is designated for determining the degree of color which may be transferred from the surface of colored textile materials to other surfaces by rubbing. It is applicable to textiles made from all fibers in the form of yarn or fabric whether dyed, printed or otherwise colored.

1.2 Test procedures employing white test squares, both dry and wet, with water are given.

1.3 As washing, drycleaning, shrinkage, ironing, finishing, etc., may affect the degree of color transfer from a material, the test may be made before or after, or before and after, any such treatment.

2. Principle

2.1 A colored test specimen fastened to the base of a Crockmeter is rubbed with white crock test cloth under controlled conditions.

2.2 Color transferred to the white test cloth is assessed by a comparison with the AATCC Chromatic Transference Scale or Gray Scale for Staining.

3. Apparatus and Materials

3.1 AATCC Crockmeter (see 8.1, 8.2).

3.2 Crockmeter Test Cloth (see 8.3).

3.3 AATCC Chromatic Transference Scale (see 8.4).

3.4 Gray Scale for Staining with intermediate steps (see 8.4).

3.5 White AATCC Textile Blotting Paper (see 8.4).

4. Test Specimens

4.1 Two specimens are used, one each for the dry and the wet tests.

4.1.1 Flat materials—pieces at least 5.1 x 12.7 cm (2 x 5 in.). Fabrics are cut preferably with the long dimension oblique to warp and filling.

4.1.2 Yarns—knit to give a piece at least 5.1 x 12.7 cm (2 x 5 in.) as above; or wound tightly on a suitable form at least 5.1 x 2.7 cm (2 x 5 in.) with the yarn running in the long direction; or otherwise stretched (see 8.8).

5. Procedures

5.1 Dry Crocking Test

5.1.1 Place a test specimen on the base of the Crockmeter so that it rests flat on the abrasive cloth with its long dimension in the direction of rubbing (see 8.5, 8.6).

5.1.2 Mount a 5.1 x 5.1 cm (2 x 2 in.) square of white testing cloth, with the weave oblique to the direction of rubbing, over the end of the finger which projects downward from the weighted sliding arm. Use the special spiral wire clip to hold the test square in place.

5.1.3 Lower the covered finger onto the test specimen and cause it to slide back and forth twenty times by making ten complete turns of the crank at the rate of one turn per second.

5.1.4 Remove the white test square and evaluate (Section 6).

5.2 Wet Crocking Test

5.2.1 Thoroughly wet out white testing square in distilled water.

5.2.2 Bring the wet pick-up to 65± 5% based on the conditioned [27± 1C (70± 2F) and 65± 2% RH] before testing by squeezing between blotting paper (white AATCC) through a hand wringer or similar convenient means.

5.2.3 Take care to prevent evaporation from reducing the moisture content below the specified level before the actual crock test is run.

5.2.4 The rest of the procedure is the same as the dry crocking test (Section 5.1).

5.2.5 Air dry the white test square before evaluating. In the case of napped, brushed or sanded material when loose fiber might interfere with the rating, remove the extraneous fibrous material by pressing lightly on the crock circle with the sticky side of cellophane tape before evaluating.

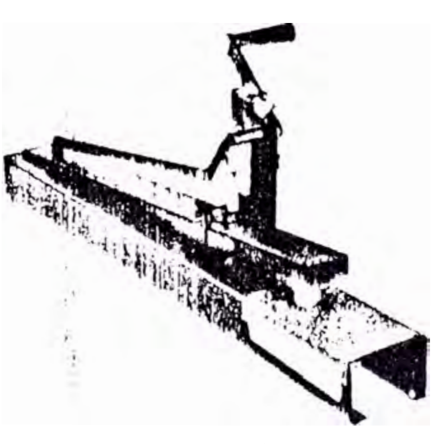

Fig. 1—Crockmeter

6. Evaluation

6.1 Evaluate the amount of color transferred from the specimen to the white test square under examination by means of the AATCC Chromatic Transference Scale or the Gray Scale for Staining (see 8.9).

6.2 Back the test square with three layers of white test cloth while evaluating.

6.3 Classify dry and wet crocking fastness as follows:

Class 5—negligible or no color transfer.

Class 4.5—color transfer equivalent to Step 4-5 on the Gray Scale for Staining.

Class 4—color transfer equivalent to Row 4 on the AATCC Chromatic Transference Scale or Step 4 on the Gray Scale for Staining.

Class 3.5—color transfer equivalent to Step 3-4 on the Gray Scale for Staining.

Class 3—color transfer equivalent to Row 3 on the AATCC Chromatic Transference Scale or Step 3 on the Gray Scale for Staining.

Class 2.5—color transfer equivalent to Step 2-3 on the Gray Scale for Staining.

Class 2—color transfer equivalent to Row 2 on the AATCC Chromatic Transference Scale or Step 2 on the Gray Scale for Staining.

Class 1.5—color transfer equivalent to Step 1-2 on the Gray Scale for Staining.

Class 1—color transfer equivalent to Row 1 on the AATCC Chromatic Transference Scale or Step 1 on the Gray Scale for Staining.

7. Report

7.1 Report the class determined in section 6.5.

7.2 Indicate whether dry or wet crocking test.

7.3 Indicate whether Gray Scale for Staining or AATCC Chromatic Transference Scale was used for evaluating staining (see 8.7).

7.4 If any pretreatment or aftertreatment was given to any specimens

(Section 1.3) indicate method of treatment.

8. Notes

8.1 The AATCC Crockmeter provides a reciprocating rubbing motion simulating the action of a human finger and forearm. The counting device, shown attached, (Fig. 1) is useful when prolonged rubbings are required, and is available, at extra cost, if desired.

8.2 The AATCC Crockmeter is so designed that the 1.5 cm (⅝ in.) diameter finger moves to and fro, with each complete turn of the crank, in a straight line along a 10.4 ± 3.2 cm (4.125 ± 0.125 in.) track on the specimen, with a downward force of 900 gm (32 oz). The AATCC Crockmeter is available from Atlas Electric Devices Company, 4114 North Ravenswood Avenue, Chicago, Illinois 60613.

8.3 Crockmeter Test Cloth, 80 x 84 combed cotton, desized, bleached (no optical brightener or finishing material present) is available from Testfabrics, Inc., P. O. Drawer O, Middlesex, N. J. 08846.

8.4 AATCC Chromatic Transference Scales and Gray Scales for Staining are available from AATCC, P. O. Box 12215, Research Triangle Park, N. C. 27709. White AATCC Textile Blotting Paper available from James River Paper Co., P. O. Box 2218, Richmond, Va. 23217.

8.5 Accidental damage to the rubbing finger, spiral clip or abrasive paper should be repaired as follows; neatly renew the abrasive paper; bend the clip further open or shut, over an inserted rod of the correct diameter, as required; resurface the finger by movement on an extra piece of fine emery cloth in a manner simulating regular use.

8.6 The abrasive material currently supplied with the Crockmeter is "Wet or Dry Trimite, Waterproof Silicon Carbide, W-320-A Soft Back" manufactured by Minnesota Mining and Manufacturing Co. Replacement pieces are available from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, Ill. 60613.

8.7 It has been noted that different ratings may result depending upon whether the Gray Scale for Staining or AATCC Chromatic Transference Scale is used for the evaluation. It is, therefore, important to report which scale was used.

8.8 For more convenient crock testing of multiple strands of yarn or thread a dowel attachment has been found useful. This attachment was developed to avoid the tendency of the standard finger to dig into and push aside the yarns, or slide off them and possibly give erroneous results. This attachment is 2.5 cm (1 in.) in diameter by 5.1 cm (2 in.) long. Positioned on its side and held in place by the standard finger, it provides a wider test area, and holds the white test square by two spring loaded clips. For additional information on this development see the article by C. R. Trommer, "Modification of the AATCC Crockmeter for Yarn Testing," *American Dyestuff Reporter,* Vol. *45,* No. 12, pages 357-9, June 4, 1956; also the article by S. Korpanty and C. R. Trommer, "An Improved Crockmeter for Yarn Testing," *American Dyestuff Reporter,* Vol. *48,* No. 6, page 40, March 23, 1959.

8.9 For very critical evaluations and in cases of arbitration, ratings must be based on the geometric gray scale for evaluating staining.

ANEXO 12

AATCC Test Method 133-1979

Colorfastness to Heat: Hot Pressing

Developed in 1969 by AATCC Committee RR54; revised 1973; supersedes AATCC 5-1962; reaffirmed 1976, 1979.

1. Purpose and Scope

1.1 This method is intended for determining the resistance of the color of textiles of all kinds and in all forms to color change, and color transfer when subjected to hot pressing. Tests are given for hot pressing when the fabric is dry, damp and wet. The textile end use usually determines which tests should be made.

2. Principle

2.1 Dry Pressing. The dry specimen is pressed with a heating device of a specified temperature, time and weight.

2.2 Damp Pressing. The dry specimen is covered with a wet, undyed cotton cloth and pressed with a heating device of a specified temperature, time and weight.

2.3 Wet Pressing. The wet specimen is covered with a wet, undyed cotton cloth and pressed with a heating device of specified temperature and weight.

3. Apparatus and Materials

3.1 Heating device, providing even heat transfer to the specimen from the top by close contact at a controlled temperature (see 5.1, 8.1, 8.2 and 8.5) and giving a pressure on the specimen of 40 ± 10 g/cm² (9 ± 2 oz/in.²) (see 8.4).

3.2 A smooth asbestos sheet of between 3-6 mm (⅛-¼ in.) (see 8.3 and 8.8).

3.3 Wool flannel of approximately 260 g/m² (7.75 oz/yd²) (see 8.8). Two layers of this material are used to make a pad of approximately 3 mm (⅛ in.) thickness. Similar, smooth wool fabrics or felt to give a pad about 3 mm (⅛ in.) thick could be used.

3.4 An undyed, bleached and not mercerized cotton cloth, with a smooth surface 100-130 g/m² (3.00-3.75 oz/yd²).

3.5 Gray Scale for Color Change (see 8.7).

3.6 Gray Scale for Staining (see 8.7).

3.7 AATCC Chromatic Transference Scale (see 8.7).

4. Test Specimen

4.1 If the textile to be tested is fabric, a piece 12 cm x 4 cm (4½ in. x 2 in.) is required.

4.2 If the textile to be tested is yarn or thread, knit it into fabric and use a piece 13 cm x 4 cm (4½ in. x 2 in.) or wind it around a piece of thin inert material 12 cm x 4 cm (4½ in. x 2 in.) to obtain the area of the textile for test.

5. Procedure

5.1 The following temperatures are used (see 8.1):

110 ± 2C	(230 ± 4F)
150 ± 2C	(302 ± 4F)
200 ± 2C	(392 ± 4F)

When necessary, other temperatures may be used, provided they are specially noted in the report (see Table 1).

5.2 Specimens of materials that have been subjected to any heat or drying treatment must be allowed to condition (by exposure to air at 65 ± 2% relative humidity and a temperature of 20 ± 2C (68 ± 4F), before they are tested.

5.3 The bottom plate of the heating device is covered with asbestos sheeting (see 3.2, 8.3) wool flannel (see 3.3, 8.3) and dry, undyed cotton cloth (see 3.4; also note 8.3 and 8.4).

5.4 Dry Pressing. Place dry specimen on top of the cotton cloth covering the wool flannel pad (see 5.3, 8.3). Lower top plate of heating device and leave specimen for 15 seconds at the specified pressing temperature.

5.5 Damp Pressing. Place dry specimen on top of the cotton cloth covering the wool flannel padding (see 5.3, 8.3). Soak a piece of undyed cotton cloth 12 cm x 4 cm (4½ in. x 2 in.) in distilled water. and squeeze or extract it to contain its own weight of water. Place the wet cloth on top of the dry specimen. Lower the top plate of the heating device and leave specimen for 15 seconds at the specified pressing temperature.

5.6 Wet Pressing. Soak the dyed specimen and a piece of undyed cotton cloth 12 cm x 4 cm (4½ in. x 2 in.) (see 3.4) in distilled water and squeeze or extract them to contain their own weight of water. Place the wet specimen on top of the dry cotton cloth covering the wool flannel pad (see 5.3, 8.3) and place the wet, undyed cloth on the specimen. Lower the top plate of the heating device and leave specimen for 15 seconds at the specified pressing temperature.

6. Evaluation

6.1 Assess the change in color of the specimen with the Gray Scale for Color Change immediately and again after the specimen has been allowed to condition for four hours in the standard atmosphere. 20 ± 2C, (65 ± 4F).

6.2 Assess the staining of the undyed cloths with the Gray Scale for Staining. The more heavily stained side of the undyed cotton specimen must be assessed. The alternative use of the AATCC Chromatic Transference Scale is also permitted (see 8.9).

7. Report

7.1 Report the test procedure (dry, damp or wet) and the temperature of the heating device. Report the numerical rating for change in color immediately after testing and after conditioning for four hours at 65 ± 2% relative humidity and a temperature of 20 ± 2C (68 ± 4F). Report the numerical rating of the staining of the undyed cotton cloth. Report which scale was used for evaluating staining.

Table I—Safe Ironing Temperature Guide

Class O Below 121C (250F)	Class I 121 to 135C (250 to 275F)	Class II 149 to 183C (300 to 325F)	Class III 177 to 191C (350 to 375F)	Class IV 204C (400F) and Above
Modacrylic 93 to 121C (200 to 250F)	Acetate		Nylon 6,6	Cotton
Olefin (Polyethylene) 79 to 121C (175 to 250F)	Olefin (Polypropylene)	Acrylic Azlon Nylon 6	Polyester	Fluorocarbon Glass Hemp, Jute, Ramie
Rubber 82 to 93C (180 to 200F)	Silk	Spandex Wool		Linen Rayon, Viscose
Saran 66 to 93C (150 to 200F)				Triacetate (heat set)
Vinyon 54C (130F)				

8. Notes

8.1 The pressing temperature depends to a large extent on the type of fiber and on the construction of the fabric or garment. In the case of blends, it is further suggested to use the temperature appropriate to the fiber with the lowest heat resistance. The indicated temperatures cover three commonly used pressing conditions.

8.2 A suitable heating device is the current production of the Atlas Scorch Tester. Older Scorch Tester units now in use can be modified to make them suitable by changing of the hinge on the head assembly and by modification of the heat controlling unit. Both the Scorch Tester and modification kit for older units are available from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, Ill. 60613.

8.3 The asbestos sheet (see 8.8) used for insulation should be smooth and not warped. It is best to complete specimen assembly on the asbestos sheet before placing it on the heating device. The asbestos should be cooled and the wet wool should be dried between tests. This insulating material must be used, whether the bottom plate is heated or not, to prevent heat to or from the bottom of the test assembly.

8.4 In order to obtain the pressure per unit area 40 ± 10g/cm^2 (9 ± 2 oz/in.^{2}) the total area of the wool flannel padding should bear a suitable relationship to the mass of the plate pressing down on the padding. If the fabric to be tested has an appreciable thickness, it is necessary to either increase the area of the test specimen; or to augment the pressure-bearing surface using a suitable template made from the same material as the test specimen. If the plates of the heating device are smaller than the specimen size, the pressure depends on the design of the apparatus (ratio of mass and area of top plate).

8.5 During the heating-up period of the heating device and between the actual test periods, both plates of the heating device should be in contact to insure a uniform distribution.

8.6 For less critical testing, a household iron may be used; but its temperature should be measured with a surface pyrometer or with temperature sensitive papers. The iron should be weighted so that its area and total weight are in the appropriate ratio to exert a pressure of 40 ± 10 g/cm^2 (9 ± 2 oz/ in.^{2}). However, due to temperature fluctuation during on-off differences over the iron surface, the accuracy and reproducibility are limited. When a hand iron is used, it must be stated in the report.

8.7 Available from AATCC, P. O. Box 12215, Research Triangle Park, N. C. 27709.

8.8 Available from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, Ill. 60613.

8.9 For very critical evaluations and in the cases of arbitration, ratings must be based on the geometric Gray Scale for Staining.

ANEXO 13 a

MUESTRA DE SOLIDEZ AL LAVADO DOMESTICO ISO/C06 C2S 60°C:

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PROGRAMA de COLORIMETRIA                                   (C) datacolor V2.3

Solideces de los colores ISO 105-A04/05 CIE Lab

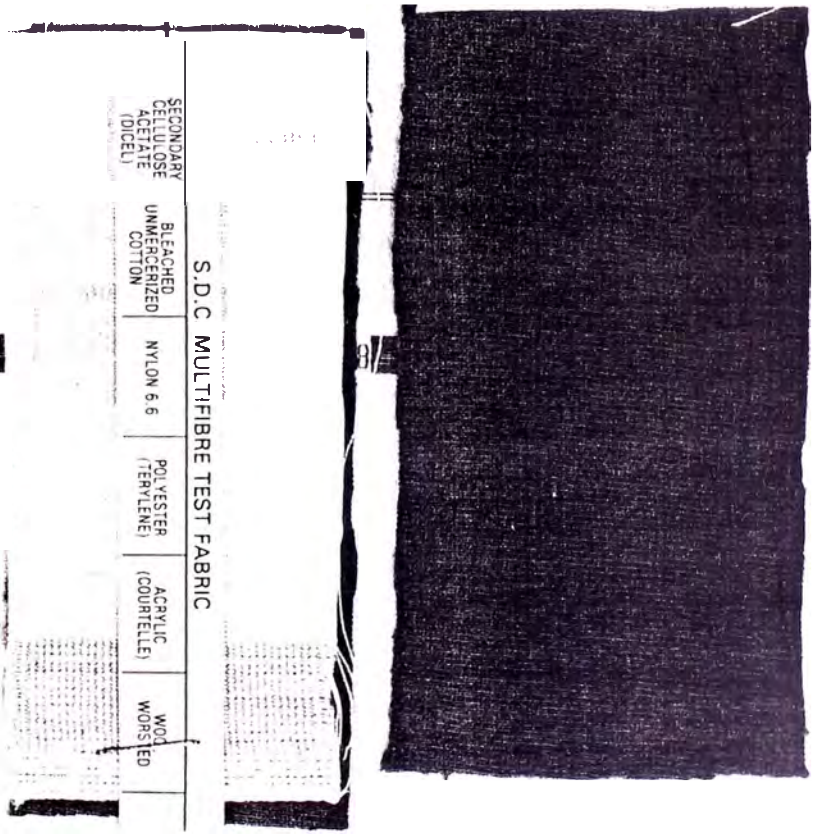
Muestra      :VER01 VERDE P01 30/1        Referencia :WHP301 REFERENCIA 30/1
Iluminantes  Ensuciabilidad    Cambio Color          LRT             L-LRT
D65                       5               5        23.47             70.37
A                         5               5        23.52             70.41
TL84                      5               5        23.41             70.50



OPCION  : CPY

F1 LST  F2      F3 PRT  F4      F5
```

D65 ......LUZ DE DIA
A ....LUZ AMARILLA
TL84 .....LUZ BLANCA

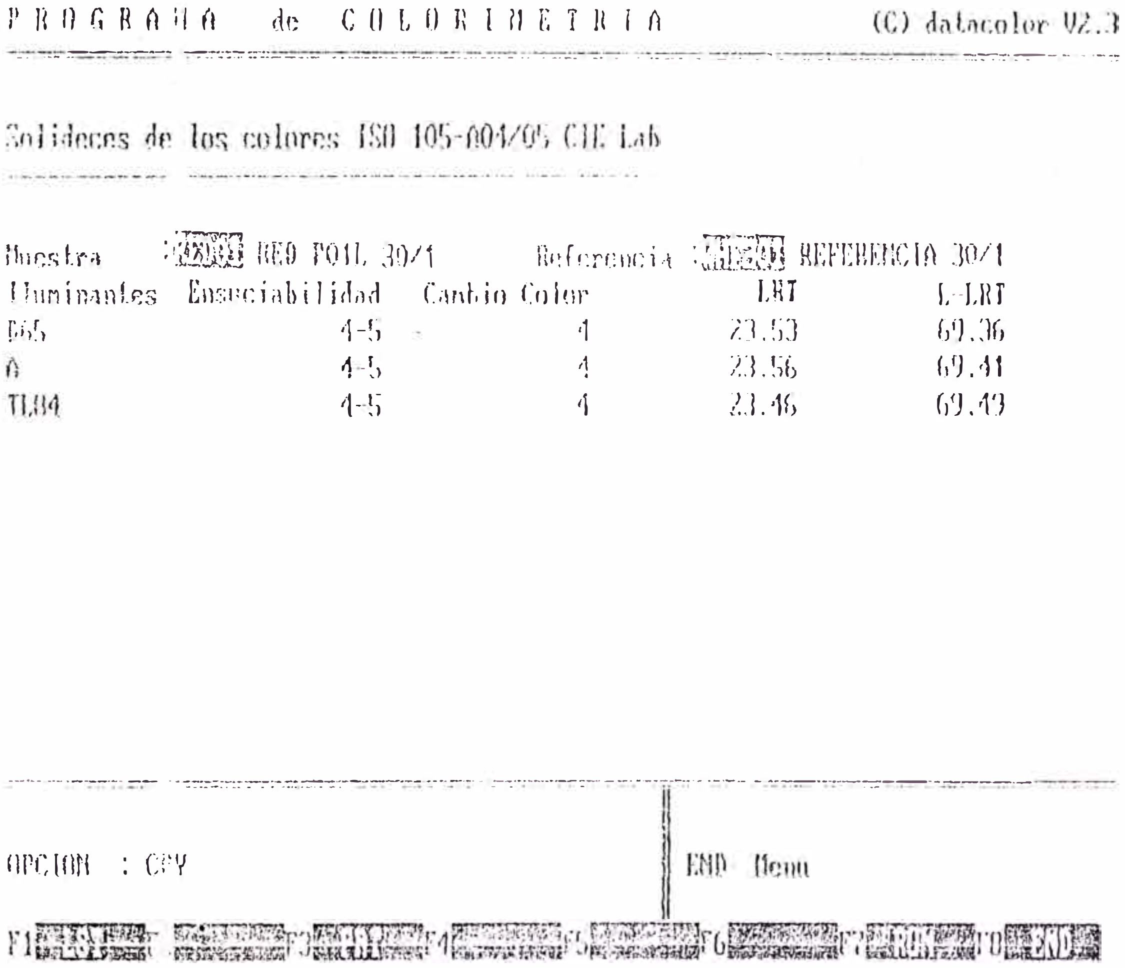


ISO/C06C2S,60°C

AATCC61,2A49°C

ANEXO 13 b

MUESTRA DE SOLIDEZ AL FROTE HUMEDO TEST METHOD 8-1977 AATCC:



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P R O G R A M A   de   C O L O R I M E T R I A              (C) datacolor V2.3
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Solideces de los colores ISO 105-A04/05 CIE Lab
-----------------------------------------------

Muestra      [illegible] RED FOIL 30/1      Referencia [illegible] REFERENCIA 30/1
Iluminantes  Ensuciabilidad   Cambio Color            LRT          L-LRT
D65                     4-5              4          23.53          69.36
A                       4-5              4          23.56          69.41
TL84                    4-5              4          23.46          69.43



--------------------------------------------------------------------------------
                                            ||
OPCION  : CPY                               || END  Menu
                                            ||
F1[illegible] [illegible]F3[illegible]F4[illegible]F5[illegible]F6[illegible]F7[illegible]F8 END
```
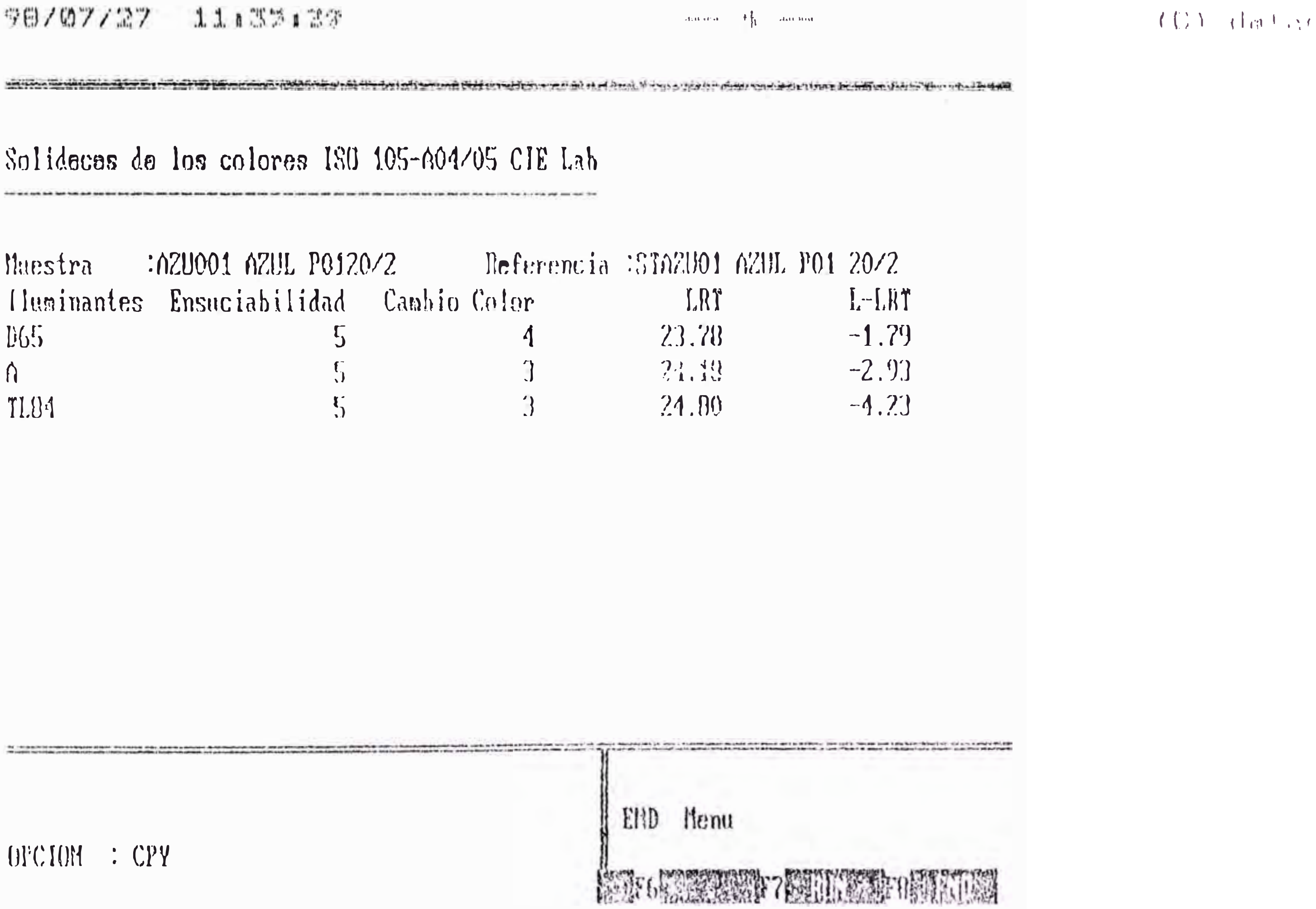

D65........LUZ DE DIA
A............LUZ AMARILLA
TL84......LUZ BLANCA

ANEXO 13 c

MUESTRA DE SOLIDEZ AL FROTE SECO TEST METHOD 8-1977 AATCC:

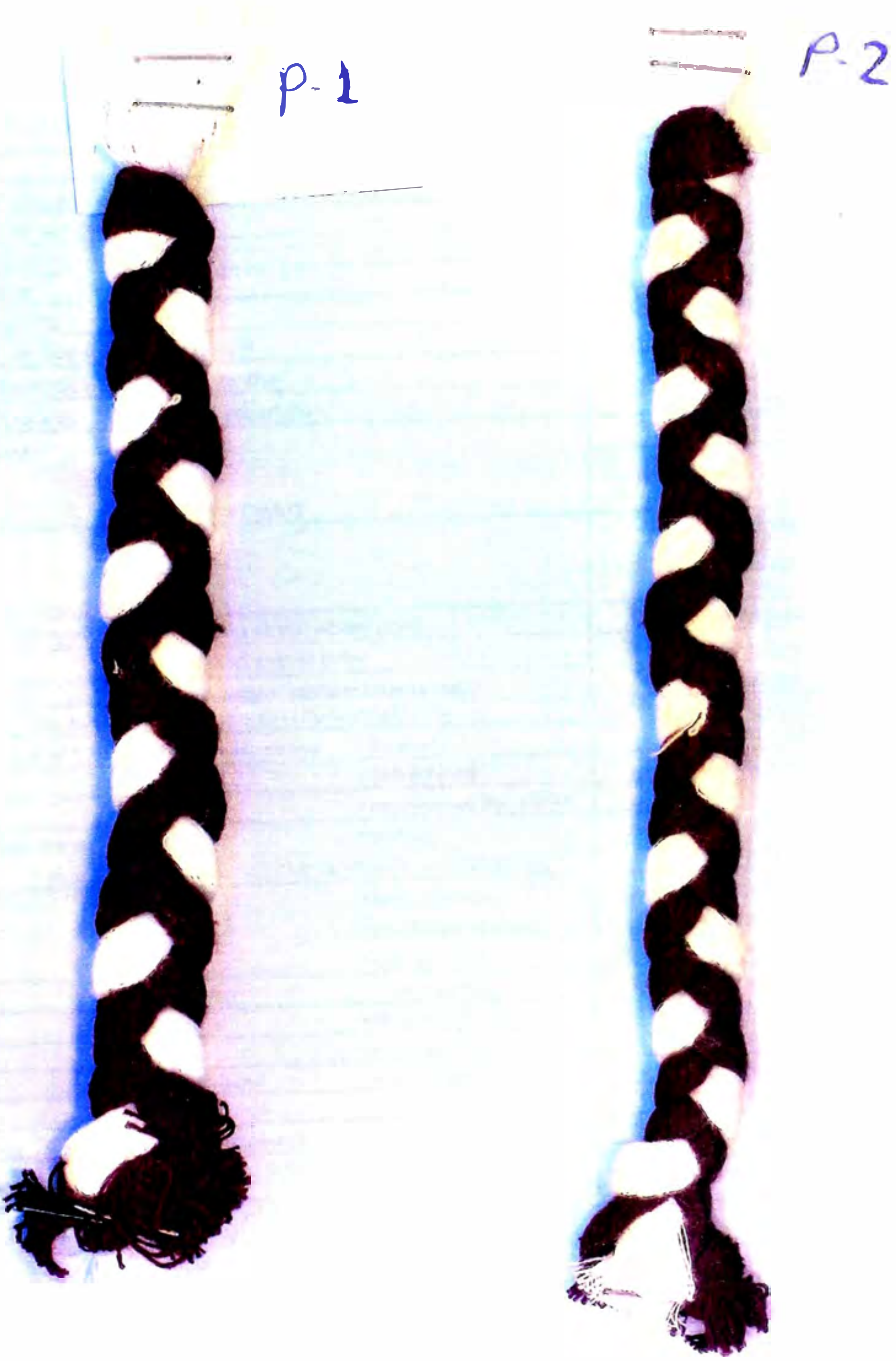


```
98/07/27   11:35:29                                              (C) datac

Solidecas de los colores ISO 105-A04/05 CIE Lab
------------------------------------------------

Muestra     :AZU001 AZUL P0120/2       Deferencia :STAZU01 AZUL P01 20/2
Iluminantes  Ensuciabilidad   Cambio Color          LRT            L-LRT
D65                       5              4        23.78            -1.79
A                         5              3        24.19            -2.93
TL84                      5              3        24.00            -4.23


                                      END  Menu
OPCION  : CPY
                                     F6 [illegible] F7 [illegible] F8 [illegible]
```

D65........LUZ DE DIA
A.............LUZ AMARILLA
TL84......LUZ BLANCA

ANEXO 13 d

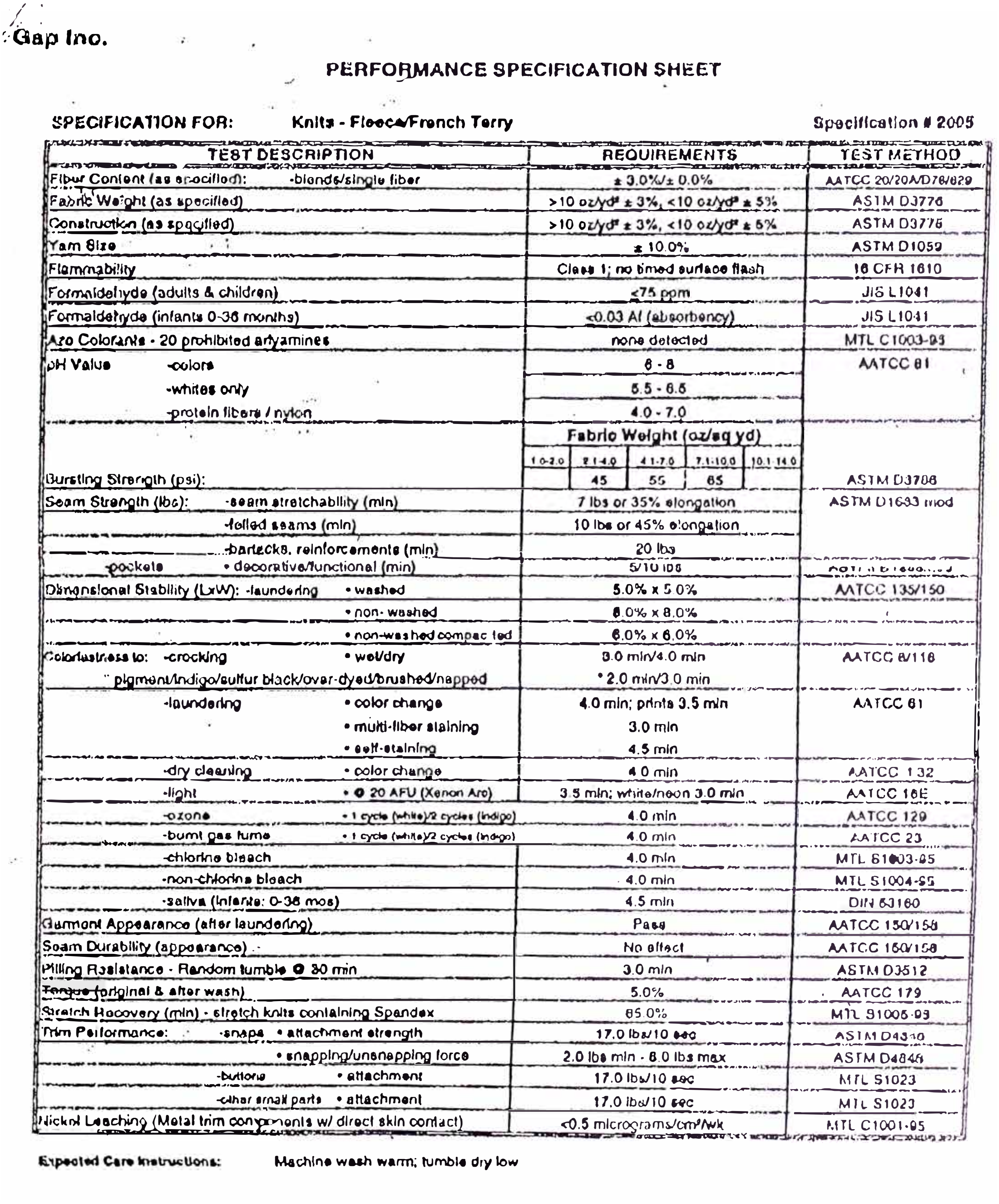
MUESTRA DE SOLIDEZ AL LAVADO “MUESTRA DE LA CORBATA



AUG-06 98 FRI 16:55 AVENTURA S.A. 727264

ANEXO 14

ESPECIFICACIONES TECNICAS:
PARA PRENDAS DE PUNTO:



Gap Inc.

PERFORMANCE SPECIFICATION SHEET

SPECIFICATION FOR: **Knits - Fleece/French Terry** **Specification # 2005**

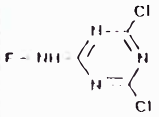
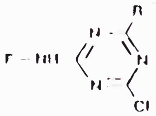
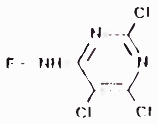
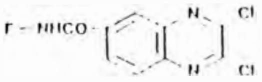
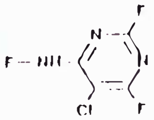
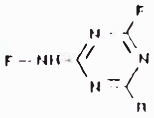
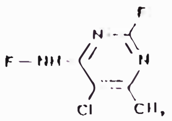
<table>
<tr><th>TEST DESCRIPTION</th><th colspan="5">REQUIREMENTS</th><th>TEST METHOD</th></tr>
<tr><td>Fiber Content (as specified): -blends/single fiber</td><td colspan="5">± 3.0%/± 0.0%</td><td>AATCC 20/20A/D76/629</td></tr>
<tr><td>Fabric Weight (as specified)</td><td colspan="5">>10 oz/yd² ± 3%, <10 oz/yd² ± 5%</td><td>ASTM D3776</td></tr>
<tr><td>Construction (as specified)</td><td colspan="5">>10 oz/yd² ± 3%, <10 oz/yd² ± 5%</td><td>ASTM D3775</td></tr>
<tr><td>Yarn Size</td><td colspan="5">± 10.0%</td><td>ASTM D1059</td></tr>
<tr><td>Flammability</td><td colspan="5">Class 1; no timed surface flash</td><td>16 CFR 1610</td></tr>
<tr><td>Formaldehyde (adults & children)</td><td colspan="5"><75 ppm</td><td>JIS L1041</td></tr>
<tr><td>Formaldehyde (infants 0-36 months)</td><td colspan="5"><0.03 Af (absorbency)</td><td>JIS L1041</td></tr>
<tr><td>Azo Colorants - 20 prohibited arylamines</td><td colspan="5">none detected</td><td>MTL C1003-95</td></tr>
<tr><td>pH Value -colors</td><td colspan="5">6 - 8</td><td>AATCC 81</td></tr>
<tr><td>-whites only</td><td colspan="5">5.5 - 6.5</td><td></td></tr>
<tr><td>-protein fibers / nylon</td><td colspan="5">4.0 - 7.0</td><td></td></tr>
<tr><td></td><td colspan="5">Fabric Weight (oz/sq yd)</td><td></td></tr>
<tr><td></td><td>1.0-2.0</td><td>2.1-4.0</td><td>4.1-7.0</td><td>7.1-10.0</td><td>10.1-14.0</td><td></td></tr>
<tr><td>Bursting Strength (psi):</td><td></td><td>45</td><td>55</td><td>65</td><td></td><td>ASTM D3786</td></tr>
<tr><td>Seam Strength (lbs): -seam stretchability (min)</td><td colspan="5">7 lbs or 35% elongation</td><td>ASTM D1683 mod</td></tr>
<tr><td>-felled seams (min)</td><td colspan="5">10 lbs or 45% elongation</td><td></td></tr>
<tr><td>-bartacks, reinforcements (min)</td><td colspan="5">20 lbs</td><td></td></tr>
<tr><td>-pockets • decorative/functional (min)</td><td colspan="5">5/10 lbs</td><td>[illegible]</td></tr>
<tr><td>Dimensional Stability (LxW): -laundering • washed</td><td colspan="5">5.0% x 5.0%</td><td>AATCC 135/150</td></tr>
<tr><td>• non- washed</td><td colspan="5">8.0% x 8.0%</td><td></td></tr>
<tr><td>• non-washed compacted</td><td colspan="5">6.0% x 6.0%</td><td></td></tr>
<tr><td>Colorfastness to: -crocking • wet/dry</td><td colspan="5">3.0 min/4.0 min</td><td>AATCC 8/116</td></tr>
<tr><td>* pigment/indigo/sulfur black/over-dyed/brushed/napped</td><td colspan="5">* 2.0 min/3.0 min</td><td></td></tr>
<tr><td>-laundering • color change</td><td colspan="5">4.0 min; prints 3.5 min</td><td>AATCC 61</td></tr>
<tr><td>• multi-fiber staining</td><td colspan="5">3.0 min</td><td></td></tr>
<tr><td>• self-staining</td><td colspan="5">4.5 min</td><td></td></tr>
<tr><td>-dry cleaning • color change</td><td colspan="5">4.0 min</td><td>AATCC 132</td></tr>
<tr><td>-light • @ 20 AFU (Xenon Arc)</td><td colspan="5">3.5 min; white/neon 3.0 min</td><td>AATCC 16E</td></tr>
<tr><td>-ozone • 1 cycle (white)/2 cycles (indigo)</td><td colspan="5">4.0 min</td><td>AATCC 129</td></tr>
<tr><td>-burnt gas fume • 1 cycle (white)/2 cycles (indigo)</td><td colspan="5">4.0 min</td><td>AATCC 23</td></tr>
<tr><td>-chlorine bleach</td><td colspan="5">4.0 min</td><td>MTL S1003-95</td></tr>
<tr><td>-non-chlorine bleach</td><td colspan="5">4.0 min</td><td>MTL S1004-95</td></tr>
<tr><td>-saliva (infants: 0-36 mos)</td><td colspan="5">4.5 min</td><td>DIN 53160</td></tr>
<tr><td>Garment Appearance (after laundering)</td><td colspan="5">Pass</td><td>AATCC 150/158</td></tr>
<tr><td>Seam Durability (appearance)</td><td colspan="5">No effect</td><td>AATCC 150/158</td></tr>
<tr><td>Pilling Resistance - Random tumble @ 30 min</td><td colspan="5">3.0 min</td><td>ASTM D3512</td></tr>
<tr><td>~~Torque~~ (original & after wash)</td><td colspan="5">5.0%</td><td>AATCC 179</td></tr>
<tr><td>Stretch Recovery (min) - stretch knits containing Spandex</td><td colspan="5">85.0%</td><td>MTL S1006-93</td></tr>
<tr><td>Trim Performance: -snaps • attachment strength</td><td colspan="5">17.0 lbs/10 sec</td><td>ASTM D4340</td></tr>
<tr><td>• snapping/unsnapping force</td><td colspan="5">2.0 lbs min - 8.0 lbs max</td><td>ASTM D4846</td></tr>
<tr><td>-buttons • attachment</td><td colspan="5">17.0 lbs/10 sec</td><td>MTL S1023</td></tr>
<tr><td>-other small parts • attachment</td><td colspan="5">17.0 lbs/10 sec</td><td>MTL S1023</td></tr>
<tr><td>Nickel Leaching (Metal trim components w/ direct skin contact)</td><td colspan="5"><0.5 micrograms/cm²/wk</td><td>MTL C1001-95</td></tr>
</table>

Expected Care Instructions: Machine wash warm; tumble dry low

ANEXO 15 COLORANTES REACTIVOS:

Commercial reactive groups

A bare thirty years after the introduction by ICI, CIBA-GEIGY and HOECHST of the first reactive dyes for cellulose, the dye manufacturers have concentrated on a few reactive systems.

Released	Reactive group	Current manufacturer commercial name	Fixation mechanism	Reactivity 5 – 1 high low	Uses (preferred)
1956	 dichlorotriazine (DCT)	ICI ®Procion MX BASF ®Basilen M etc.	SN2	5	– exhaust (40 °C) – pad batch
1957	 monochlorotriazine (MCT)	CIBA-GEIGY ®Cibacron Cibacron F ICI Procion H, HE, SP BASF Basilen E, P SANDOZ ®Drimaren P	SN2	2	– exhaust (80 °C) – pad-dry-pad-steam – pad thermofix – printing (1 phase)
1957	$F - SO_2CH_2CH_2OSO_3H$ sulphatoethyl sulphone (VS)	HOECHST ®Remazol SUMITOMO ®Sumifix etc.	A	3	– pad batch – pad-dry-pad-steam – exhaust (60 °C) – printing (2 phase)
1960	 trichloropyrimidine (TCP)	SANDOZ Drimaren Z CIBA-GEIGY Cibacron T-E	SN2	1	– exhaust (80 °C)
1961	 dichloroquinoxaline (DCQ)	BAYER Levafix E	SN2	4	– exhaust (40 °C) – pad steam – pad batch
1971 1972	 difluorochloropyrimidine (DFCP)	BAYER Levafix E-A Drimaren K	SN2	4	– exhaust (40 °C) – pad batch
1978	 monofluorotriazine (FT)	CIBA GEIGY Cibacron F BAYER Levafix E-N	SN2	4	– exhaust (40 °C) – pad batch – pad-steam
1981	 fluorochloromethyl pyrimidine	BAYER Levafix PN	SN2	2	– printing (1 phase) – pad-thermofix

'There is no such thing as a perfect reactive group. Each one has its peculiarities, but as a rule they only become apparent in marginal cases in bulk working.

ANEXO 16 EXPORTACION DE PRODUCTOS TEXTILES:

Mundo Textil Nº 48 - Lima - Perú. Pág. 16

EXPORTACIONES

DISTRIBUCION POR PRINCIPALES MERCADOS Y PRODUCTOS DURANTE 1997 (EN US$)

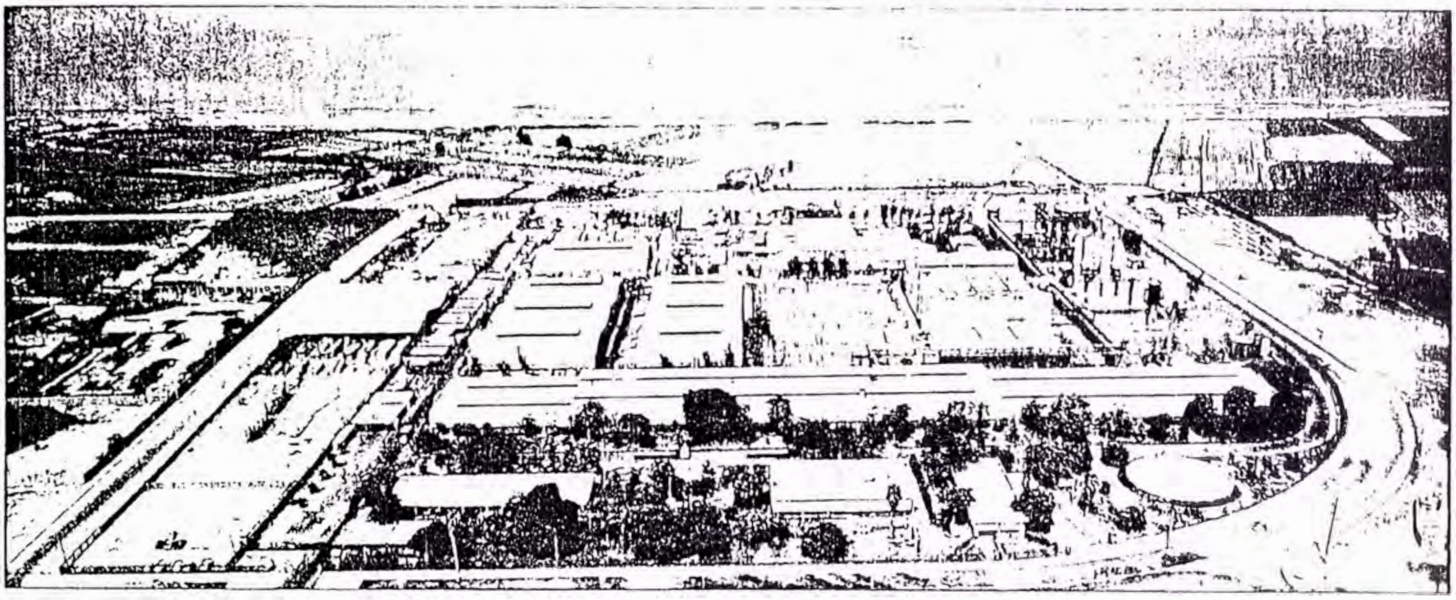
PRODUCTOS	COMUNIDAD EUROPEA	EE.UU.	JAPON	CANADA	MERCOSUR	COMUNIDAD ANDINA	MEXICO	CHILE	PANAMA	OTROS PAISES	TOTALES
	MONTO	MONTO	MONTO	MONTO	MONTO	MONTO	MONTO	MONTO	MONTO	MONTO	MONTO
Hilados e hilos de algodón	23.966.954	11.152.119	1.475.567	2.385.303	5.356.754	12.338.122	560.882	2.407.810	251.484	3.510.054	63.405.049
Hilados de lana-alpaca	8.946.667	4.141.060	6.647.740	59.932	14.458	1.144.098		857.855		2.700.810	24.512.620
Hilados e hilos artif. o sintet.	81.907		36.268		223.938	5.017.195		221.867		1.452	5.582.627
Hilados de otras fibras					3.050	13.138		76.837			93.025
Tejidos de algodón	8.010.432	6.522.178	68.139	178.071	799.121	25.681.880	1.937.663	7.680.684	2.207.325	4.714.426	57.799.919
Tejidos de lana-alpaca	4.411.472	3.130.927	1.037.998	1.625.197	557.914	6.948.778	135.562	480.603	292.378	6.441.004	25.061.833
Tejidos de fibras artif. o sintet.	1.356.486	336.227		51.317	989.365	272.140		892.143	7.432	1.449.293	5.354.403
Tejidos de otras fibras	15.555	710.140	110	782.531	99.060	149.827	124.394	39.864		152.103	2.073.584
Prendas de algodón	71.487.814	184.307.319	1.846.835	2.720.208	1.599.851	13.264.357	1.615.466	6.755.559	8.639.942	6.080.940	298.318.291
Prendas de lana-alpaca	7.383.548	6.810.131	2.734.577	612.126	417.255	152.467	370.042	119.622		920.149	19.519.917
Prendas de fibras artif. o sintet.	781.951	2.021.979		36.268	497.934	308.537	37.755	203.216		170.721	4.058.361
Las demás prendas	182.622	145.152	65.454	4.053	8.414	118.528	50.771	155.118	26.940	62.977	820.029
Confecc. de algodón	705.650	1.728.239	30.485		12.796	88.780		235.913		25.796	2.827.659
Confecc. de lana-alpaca	486.236	69.855	937	12	432	55.399	725			13.372	626.968
Confecc. de fibras artif. o sintet.	312	598	240			273.389		217.305			491.844
Las demás confecciones	31.955	28.504	113	760	21.964	295.816		14.132		34.064	427.308
Lana-alpaca (cardada, peinada, Tops)	10.040.696	124.851	2.883.732		26.487	704.501		223.366		1.371.195	15.374.828
Fibras artificiales o sintéticas	17		544		210.365	7.663.950	1.975	4.222.154		1.845.804	13.944.809
Otras fibras	2										2
Cables de filamentos sintéticos		276.742			56.095	15.540.133	3.196	4.823.292		3.599.301	24.298.759
Redes confeccionadas para la pesca									7.717		-
Otros textiles no especificados	742.926	708.203	1.792	57.209	675	700.839	29.488	5.147.706		21.989	7.418.544
TOTALES	138.633.202	222.214.224	16.830.531	8.512.987	10.895.928	90.731.874	4.867.919	34.775.046	11.433.218	33.115.450	572.010.379

FUENTE : ADUANAS
ELABORACION: MUNDO TEXTIL

ANEXO 17

EMPRESAS TEXTILES EXPORTADORAS:

RANKING DE EXPORTADORES 1997



Vista aerea de Sudamericana de Fibras, el mayor productor de fibras acrilicas de Sudamérica.

RANKING GENERAL	RANKING TEXTILES	EXPORTADOR	VALOR US$ (Miles)	ESTRUCT. PORCENT.	PORCENT.
29	01	Sudamericana de Fibras S.A.	38 055,28	0.56	8.72%
34	02	Textil San Cristóbal S.A.	31 582,38	0.47	7.24%
35	03	Industrias Nettalco S.A.	30 650,31	0.45	7.02%
37	04	Corporación Fabril de Confecciones S.A.	30 327,81	0.45	6.95%
40	05	Fabritex Peruana S.A.	28 314,77	0.42	6.49%
53	06	Textil del Valle S.A.	22 364,31	0.33	5.12%
56	07	Industria Textil Piura S.A.	22 294,86	0.30	5.11%
61	08	Consorcio Textil del Pacífico	19 739,41	0.29	4.52%
62	09	Textiles Populares S.A.	19 707,02	0.29	4.51%
67	10	Diseño y Color S.A.	18 625,31	0.28	4.27%
70	11	Confecciones Textimax S.A.	17 437,39	0.26	3.99%
74	12	Incalpaca Textiles Peruanos de Export S.A.	15 902,03	0.24	3.64%
80	13	Textil Trujillo S.A. TRUTEX	14 242,44	0.21	3.26%
81	14	Cotton Knit S.A	14 136,72	0.21	3.24%
87	15	Corpetex S.A.	13 679,68	0.20	3.13%
96	16	Cia. de Representaciones y Distribuciones S.A. CREDISA	12 871,64	0.19	2.95%
109	17	Mitchell y Cia.	10 489,13	0.16	2.40%
129	18	Frank y Ricky S.A.	8 809,48	0.13	2.02%
130	19	Cia. Textil El Progreso	8 748,30	0.13	2.00%
135	20	Productos del Sur S.A.	8 368,65	0.12	1.91%
148	21	Inca Tops S.A.	7 737,54	0.11	1.77%
150	22	Perú Fashion	7 595,38	0.11	1.71%
164	23	Fábrica de Tejidos La Bellota S.A	6 517,79	0.10	1.49%
165	24	Corporación Algodonera del Perú S.A.	6 426,55	0.10	1.47%
167	25	Hilandería de Algodón Peruano S.A.	6 212,94	0.09	1.42%
182	26	Industrias Full Cotton S.A	5 349,74	0.08	1.22%
	27	Creaciones Flores S.R.L.	5 038,69	0.07	1.15%
198	28	Fábrica Nac. Textil "El Amazonas"	4 792,95	0.07	1.09%

CIFRAS PRELIMINARES A ENERO 1998
COBERTURA : NACIONAL
FUENTE : ADUANAS
ELABORACION: MUNDO TEXTIL
TOTAL EXPORTACION NACIONAL: US$ 6,781'299,61
TOTAL EXPORTACION PRINCIPALES EMPRESAS TEXTILES: US$ 436'018,500

ANEXO 18

TIPOS DE TEÑIDO

El teñido en si se realiza en diferentes formas bien definidas y en cada caso con caracteristicas muy marcadas. Los tipos de teñidos están dadas por el tipo de colorante que se usa; así tenemos:

-Reactivos
-Tina
-Directos
-Otros (al Azufre, al Cobre, etc.)

TEÑIDO CON COLORANTES REACTIVOS.-

Los colorantes REACTIVOS, tienen características muy peculiares:

-Tiene excelente solidez al lavado.
-Tiene excelente solidez al frote húmedo y al frote seco.
-Existe colorantes con excelente solidez al mercerizado.
-Tiene precios muy variados, de acuerdo a las características del teñido.
-Permite tejer listados muy caprichosos, así se puede convinar rapores oscuros y claros (negros con blancos, marinos intensos con blanco, rojos intensos con blanco, etc.).

Los colorantes REACTIVOS, tienen otras características que es necesario anotar:

-Su teñido requiere de una buena preparación previa
-Se ve afectado muy fácilmente por elementos como son los alcalinos terreos y los metales pesados que normalmente trae el algodón del campo y estos elementos también viene en la sal o en el sulfato que se usa para agotar el teñido.
-No cubre la fibra inmadura del algodón
-La solidez al blanqueo con agua oxigenada o con hipoclorito de sodio es prácticamente nula.
-Se desmontan casi en su totalidad con hidrosulfito de sodio.

El teñido con colorantes REACTIVOS es el mas trabajado, mas difundido y es el que reúne mejor equilibrio en la relación costo y propiedades de uso. Definitivamente es dado por el teñido de colorantes reactivos.

Los colorantes Reactivos en la actualidad pueden ser fríos o calientes; pueden clasificarse por su naturaleza química y de estos los mas difundidos son

-Vinilsulfona: Remazol, Intracrones, Synozoles, Vinazoles, Solazoles, etc

-Bifuncionales: Remazol, Synozoles, vinazoles, Solazoles, este.

-Monofluorurotriazine: Cibacrones F, Levafix EN.

-Difloruroclоropyrimidine: Drimaren K, Levafix EA.

-Monoclorotriazine: Procion H, HE, SP.

-Otros.

TEÑIDO CON COLORANTES TINA.-

Los colorantes TINA se han usado bastante pero actualmente su uso ha disminuido considerablemente; debido a que los colorantes reactivos se han difundido grandemente por sus ventajas económicas y sus excelentes propiedades, pero hay rubros donde los colorantes tina no han podido ser reemplazados y estos aunque no son muchos viene a ser una cantidad importante así tenemos: paños e indumentaria de uso médico no descartable, color en camisería de algodón, elaboración de toallas por su alta solidez a la luz y la desinfección con cloro, las características por la que los colorantes tina viene a ser un colorante importante a la fecha son:

-Tiene excelente solidez a la luz.

-Tiene excelente solidez al blanqueo con cloro o peróxido de hidrogeno

-Tiene excelente solidez al mercerizado.

Los colorantes Tina, tienen otras características que es necesario mencionar:

-Son teñidos relativamente caros.

-Su teñido e igualacion es mas dificultoso, llegándose a desarrollar técnicas muy peculiares para cada situación.

-Su desmontado de partidas o lotes fallados es casi imposible

El teñido con colorantes TINA consiste en reducir previamente el colorante a su estado reducido denominado leuco derivado, pueden ser de origen indigoide o de origen antraquiónico (si su grupo cromógeno es -CO-C=C- CO- , o el doble grupo cetónico =C=O respectivamente) esta reducción se lleva acabo en un medio alcalino (dado por la soda cáustica) por medio de un agente reductor que viene a ser el hidrosulfito de sodio las cantidades a usarse están dadas por las tablas y son muy conocidas, se tiene que ser muy cuidadoso en esta determinación puesto que un exeso de soda cáustica puede precipitar al colorante como una sal de sodio y un faltante hará que no se reduzca por completo el colorante; de igual manera un faltante de hidrosulfito puede significar una reducción incompleta del colorante y un exceso puede ocasionar una sobre reducción que hace que el colorante cambie de matiz y pierda su afinidad hacia la fibra.

En la actualidad existen varias marcas de colorantes tina en el mercado, como Indanthrenes, Cibanones, Navinon etc. todos estos colorantes tina en esencia son los mismos y su presentación se dan en tres formas mas comunes: polvo, polvo muy fino y en pasta estos últimos son mas fáciles de reducir y por lo tanto de trabajar pero ocurre que a una prolongada exposición al medio ambiente suele concentrarse mas perdiendo agua.

Los colorantes TINA se tiñen por cuatro formas bien definidas, es decir cada colorante tiene su manera especifica de teñido; estos grupos difieren en cuanto a las condiciones de temperatura, cantidades de hidrosulfito, cantidades de soda, formas de reoxidación.

El rendimiento óptimo de los colorantes tina esta dada por la elección correcta al grupo en que pertenece el colorante. En la práctica los grupos son:

IN .- Alta concentración de soda, mayores temperaturas y no recomienda el uso de sal.
IW .-Cantidades medias de soda, temperaturas medias y recomienda uso de electrolitos para agotar el baño.
IK .-Bajas concentraciones de soda, bajas temperaturas, y altas concentraciones de electrolito.
IN especial .-Grupo especial, son casos especiales y cada colorante que pertenece a este grupo especifica claramente las condiciones de teñido.

TEÑIDO CON COLORANTES DIRECTOS.

El teñido con colorantes directos es por su procedimiento relativamente mas sencillo. Se basa en la sustantividad que tienen los colorantes por el algodón; en la actualidad existen colorantes de muy alta sustantividad.

Los teñidos pueden realizarse directamente sin tratamiento previo del algodón dependiendo del color. Esto debido a que el proceso se lleva acabo a 98ºC por lo tanto la difusión es grande.

Los colorantes DIRECTOS, tienen las siguientes características :

-Tiene baja solidez al lavado.
-Tiene baja solidez al frote humedo y al frote seco.
-La solidez al blanqueo y al mercerizado es nula.

-Existen colorantes directos con excelente solidez a la luz; de baja solidez también lo hay.

-Tiene precios muy variados, no son baratos. Pero su procedimiento de teñido es económico.

-Apesar que en la actualidad han mejorado bastante en lo que respecta a sus solideces es bastante riesgoso su uso en teñido de hilado destinado al tejido listado.

-Cubre en forma aceptable la fibra inmadura que pueda tener el algodón.

-Su teñido en muchos casos no requiere de una preparación previa

ANEXO 19

FIJACION DE COLORANTES REACTIVOS

Ejemplo : Vinilsulfón.

Lado del colorante

$NaSO_3$-cromogeno-SO_2-CH_2-CH_2-O-SO_3Na

En presencia de un álcali: OH-

$NaSO_3$-cromogeno-SO_2-$CH{=}CH_2$ + HSO_4-

Lado de la Celulosa:

OH-celu anillos d-glucopiranosa

Por su comportamiento alcohol polihidrico:

-O-celu + H+

Lado del colorante + Lado de la celulosa

$NaSO_3$-cromogeno-SO_2-$CH{=}CH_2$ + -O-celu

$\downarrow$

$NaSO_3$-cromogeno-SO_2-$C_{-}H$-CH_2-O-celu + H+

$\downarrow$

$NaSO_3$-cromogeno-SO_2-CH_2-CH_2-O-celu

II.-TEÑIDO DE ALGODÓN EN BOBINAS CRUZADAS

EMPRESA: TEXTIL PERUANA S.A.

DIRECCION: CALLE ARMANDO CAMBANA 123- CHORRILLOS.
JR. LOD ZUNGAROS 334 MATELLINI - CHORRILLOS.

CARGO : JEFE DE TINTORERIA.

TIEMPO DE SERVICIO : UN AÑO Y OCHO MESES
DEL 02/10/92 AL 15/06/94

INDICE

1.- INTRODUCCION.

TEXTIL PERUANA S.A. Empresa que en su mejor momento logro influenciar en el mercado, por la diversidad de sus productos pero fue ampliamente conocida por el Terciopelo Mill el del orillo rojo.

TEXTIL PERUANA S.A. fue una Empresa que estuvo a la altura de reconocidas Empresas como San Jacinto, Nuevo Mundo, Credisa, y otras Empresas similares; por la calidad de sus productos y por tener completo todo el circuito productivo textil:

Hilandería .

Tejeduría.

Planta de Terciopelo.

Tintorería.

Su producción totalmente de tela plana ; además del Terciopelo fue tela para sabanas, bombasi, franela, denim, camiseria, drill, satín, gasa, etc.

No obstante a ser reconocida como una Empresa Importante Textil Peruana se va a la quiebra. Consideramos por dos motivos :

- Falta de Modernización de sus diferentes plantas; ante al avance vertiginoso de la tecnología de los años 80 y el primer quinquenio de los 90 su maquinaria paso a ser rápidamente obsoleta produciéndose telas de mayor costo y de menor calidad.
- Un constante malestar laboral que ocasionó muchas horas-hombre improductivas.

Actualmente TEXTIL PERUANA se encuentra en liquidación. La planta de Tintorería fue Adquirida por COTTON DESIGNS S.A. Empresa joven con nueva mentalidad. En Textil Peruana ocupe el puesto de JEFE DE

TINTORERIA, vendida la Tintorería a COTTON DESIGNS fui contratado por esta como JEFE DE LA PLANTA DE TINTORERIA.

La planta de Hilandería fue adquirida por TEXTILES POPULARES

2.- ACTIVIDAD PROFESIONAL

En TEXTILPERUANA el cargo JEFE DE TINTORERIA por un periodo de un año y ocho meses, desde 02/10/92 al 15/06/94. Las funciones asignadas a este cargo fueron:

- Definir la secuencia de los procesos, en coordinación con la Gerencia de Producción.
- Aprobación de matices.
- Diseño de curvas de teñido.
- Selección de Colorantes, coordinando con la Gerencia de Producción; estableciendo los lineamientos de las solideces.
- Pedidos de Colorantes, Auxiliares de teñido y productos químicos; esto implica la revisión de los stock y ver los volúmenes de consumo.
- Distribuir el Personal adecuadamente y establecer las funciones de cada uno de ellos.
- Mantener una politica permanente de modernización de los equipos.
- Coordinar con la Gerencia de Producción y el Jefe de Mantenimiento los programas de mantenimiento.
- Participar en la elaboración de los programas de producción en coordinación con la Gerencia de Producción.
- Evaluar constantemente al personal.
- Mejorar los procesos buscando una mejor productividad y mejor calidad.

ORGANIGRAMA

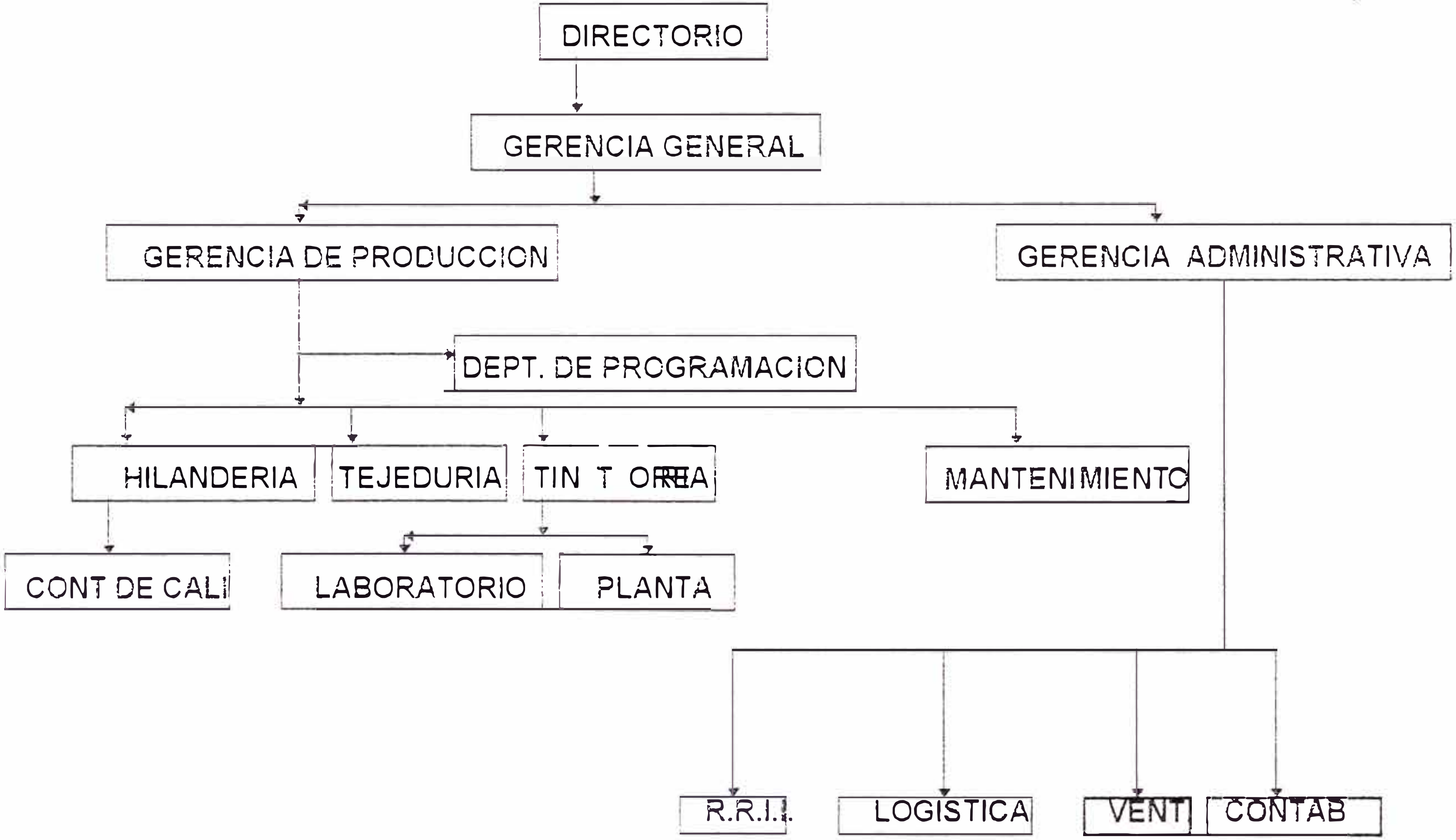


DIAGRAMA DE FLUJO GLOBAL

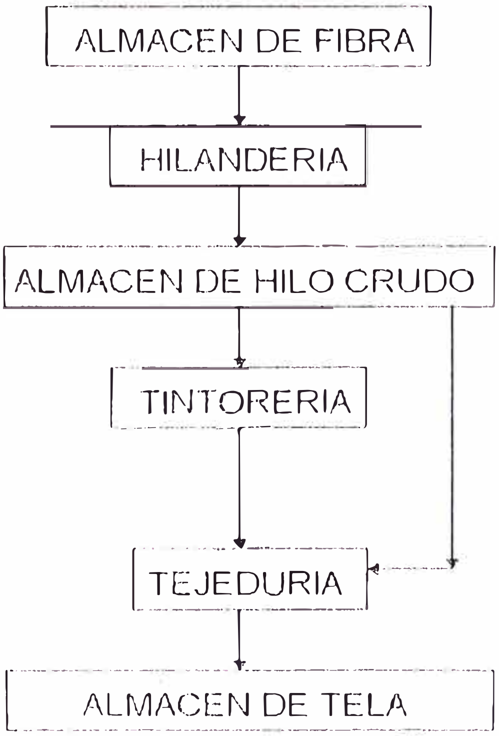
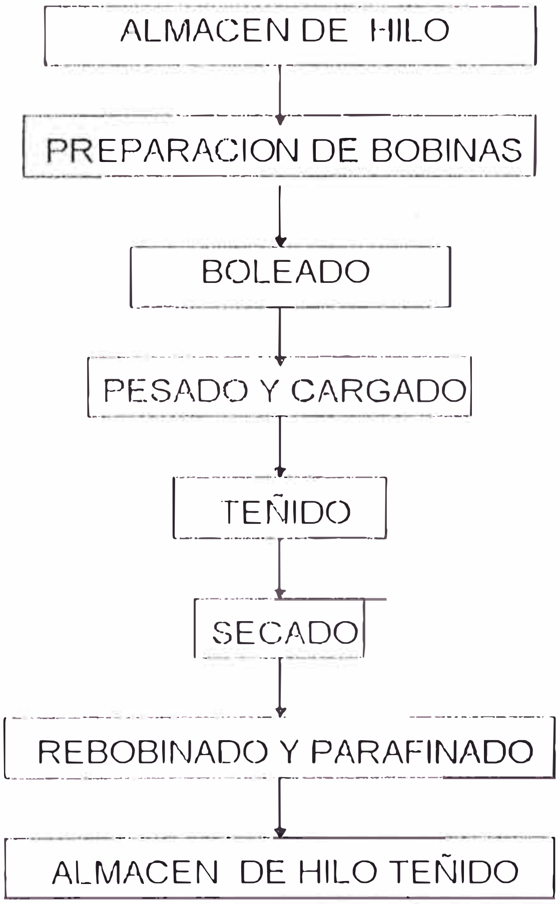


DIAGRAMA DE FLUJO EN LA TINTORERIA



TIPO DE TECNICAS DE INGENIERIA NECESARIOS PARA LA FUNCION DESEMPEÑADA:

- Ténicas de teñidos.
- Técnicas de determinación cuantitativa de productos químicos y preparación de soluciones.
- Técnicas de planeamiento de la producción.
- Estudios de tiempos y movimientos.
- Técnica de diseño de bombas.
- Cubicación de recipientes.
- Técnica de instalaciones de conexiones y accesorios de tuberías.
- Técnica de operación de ablandadores de agua.
- Técnica de diseño de intercambiadores de calor.
- Técnica de instalaciones eléctricas.
- Técnica de cálculo de la potencia de los motores.

PERSONAL A CARGO:

- Tres Ingenieros Coloristas
- Tres Tintoreros y diez Ayudantes.
- Jefe de Almacén y tres operarios.
- Jefe de coneras y once operarios.
- Tres eventuales todo servicio.

***total 35 trabajadores.

DESARROLLO DE PROYECTOS:

- Mejorar y modernizar los equipos y maquinaria.
- Instalación de una planta de confecciones.
- Elaboración de nuevos efectos en el hilo teñido.

PROCESOS SECUENCIALES CORRESPONDIENTE AL TEÑIDO DE ALGODÓN EN BOBINAS CRUZADAS:

- ELABORACION DE LAB-DIPS Y SU APROBACION.
- PREPARACION DE BOBINAS.
- BOLEADO.
- TEÑIDO.
- EXPRIMIDO.
- SECADO.
- REBOBINADO.
- LIMPIEZA Y EMBALAJE.

3.-RESUMEN.

En primer lugar, quiero señalar que al declararse TEXTIL PERUANA en quiebra COTTON DESIGNS compra la planta de TINTORERIA, y muchos de los técnicos son contratados por esta nueva empresa y esto es nuestro caso. Con el mismo cargo y desempeñándome en las mismas funciones. Es por ello que describir detalladamente las funciones y procesos seria repetitivo; esto es como se apreciará en el informe de COTTON DESIGNS se tocan cada punto mencionado en el presente informe.

El teñido de hilado en bobinas cruzadas tuvieron dos aplicaciones, gran parte se destino a la tejeduria, y lo restante se trabajo para terceros empezando de esa manera esta actividad de servicio a terceros que fue continuado por COTTON DESIGNS

Un rubro que se trabajo, en cantidades razonables fue el teñido en borra, para hacer efectos melanges, en la hilanderia; este teñido se realizan en las mismas autoclaves donde se tiñen las bobinas.

La Jefatura de Tintoreria; cual fuera la planta, afrontara una serie de situaciones que serán decisivas para la rentabilidad de esta, desde la selección de colorantes y la elaboración de procesos económicos hasta el acabado que se de al hilado teñido, incluyendo la orientación que se de a los clientes es fundamental.

III.-TEÑIDO DE ALGODÓN POR EL SISTEMA PAD BATCH

EMPRESA: **CREDISA.**

DIRECCION: CALLE LOS HORNOS 185 URB. VULCANO
ATE VITARTE

CARGO : **LABORATORISTA** - SECCION TINTORERIA

TIEMPO DE SERVICIO : TRES AÑOS
DEL 02/10/89 AL 30/09/92

INDICE

1.- INTRODUCCION.

CREDISA viene a ser una de las Empresas de mayor prestigio, en el Sector Textil en lo que se refiere a tela plana; y esto se lo debe ganado a la modernidad de su planta y equipos, a la calidad de su tela producida y al ejemplo de organización .

CREDISA Empresa netamente exportadora dirigía su producción al mercado exterior en un 95 %, incluyendo a países socialista como la URSS; desaparecido estos países sus ventas bajaron considerablemente afectando sus ingresos y por ende su crecimiento. Los productos que ofrece son desde hilo crudo, tela cruda, tela preparada, tela blanqueada y teñida, y tela acabada; todos de primera calidad con los mejores algodones pima, tanguis, cerro y mezclas con poliester .

Todo profesional que tenga la oportunidad de trabajar o por lo menos practicar en esta Empresa ganara mucha experiencia poniéndose a la vanguardia de la tecnología.

2.- ACTIVIDAD PROFESIONAL

En CREDISA ocupe el cargo de LABORATORISTA en la sección Tintorería por un periodo de tres años, desde 02/10/89 al 30/09/92. Las funciones asignadas a este cargo son:

- Control de proceso de blanqueo de tela a la continua, con análisis frecuente de la cantidad de peróxido de hidrogeno y soda cáustica.
- Matizado de Algodón y poliester usando colorantes reactivos, dispersos al azufre, y pigmentos.
- Control de calidad de los diferentes auxiliares textiles, como detergentes, humectantes, estabilizadores, suavizantes, repelentes, reticulantes, etc.
- Control de calidad de los diferentes productos químicos usados como: soda cáustica, ácido acético, peróxido de hidrogeno, sulfato de sodio, etc.
- Análisis de rutina del agua.
- Análisis físicos de rutina de la tela: encogimiento, humedad, densidad , pasadas, solideces al frote húmedo, seco, solidez al lavado, hidrofilidad, resistencia al desgarre, grado de repelencia.
- Control del proceso de teñido comparando curvas de tramitancia con datacolor.
- Evaluación de colorantes.
- Preparación de reactivos.
- Control del grado de blanco de las telas blanqueadas, con datacolor.

ORGANIGRAMA

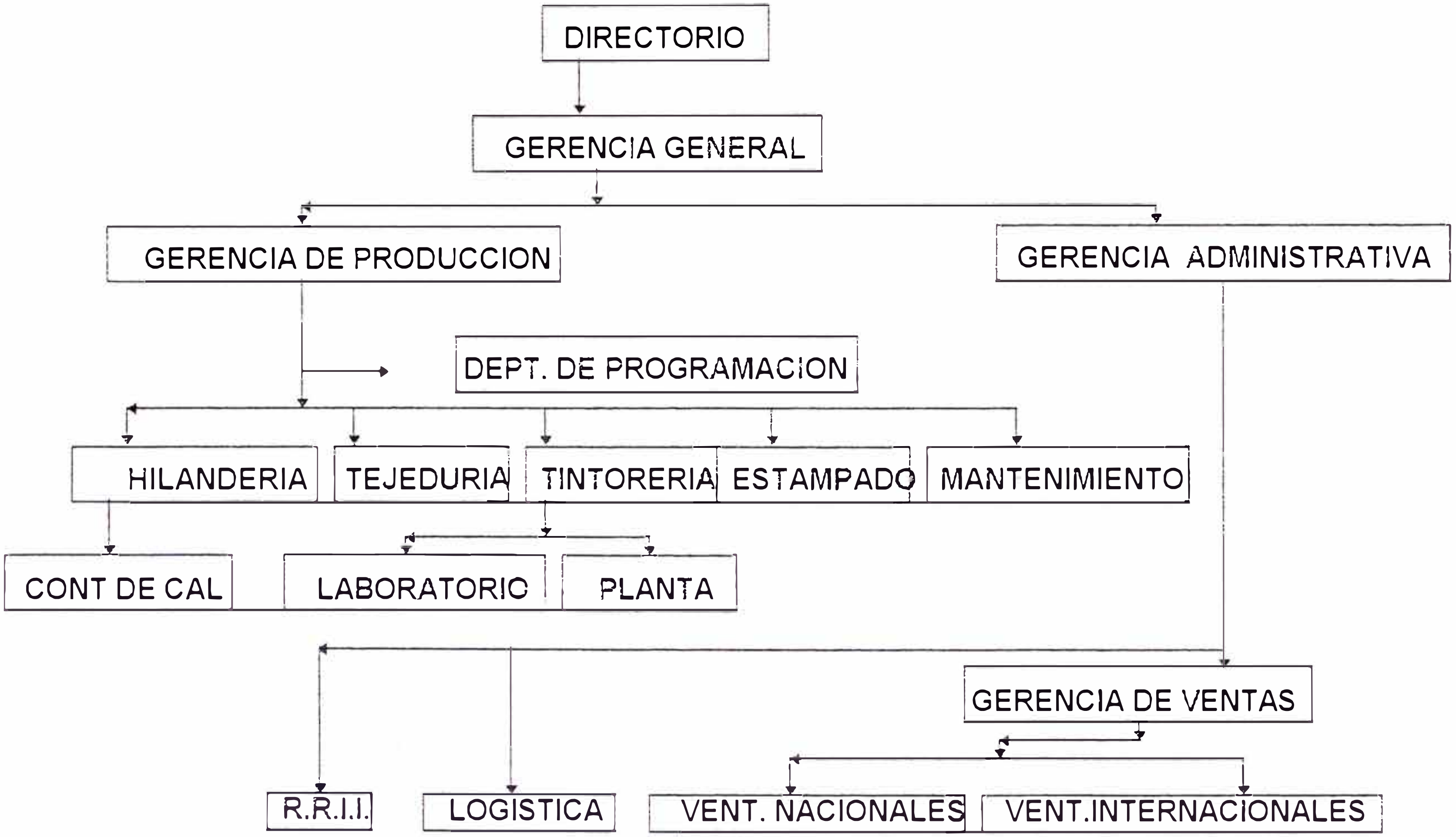


DIAGRAMA DE FLUJO GLOBAL

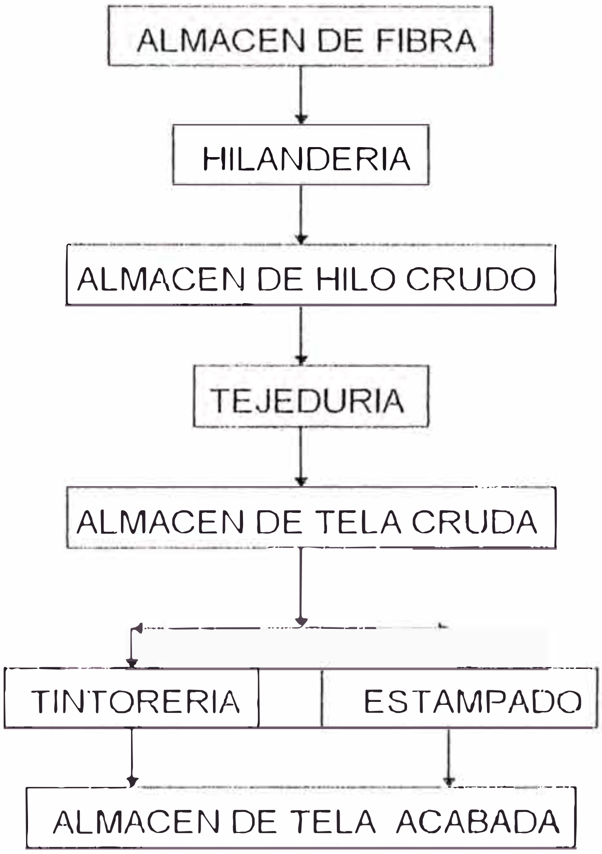
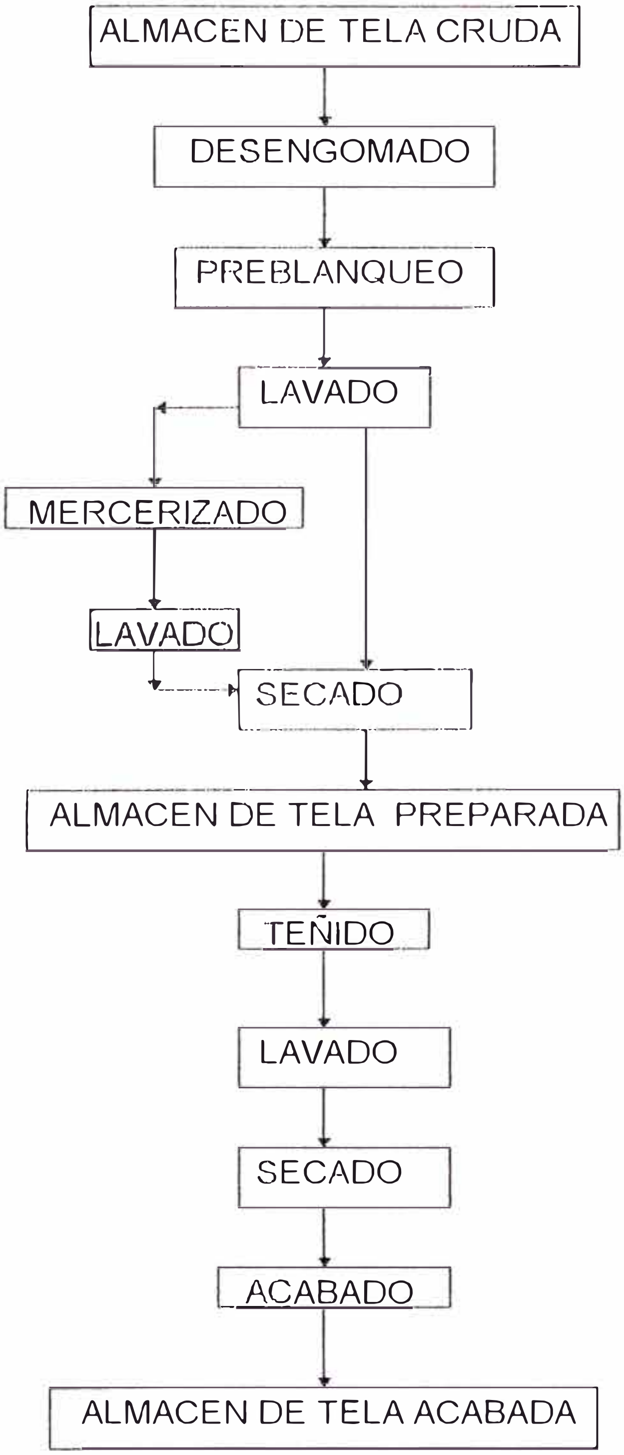


DIAGRAMA DE FLUJO EN LA TINTORERIA



TIPO DE TECNICAS DE INGENIERIA NECESARIOS PARA LA FUNCION DESEMPEÑADA:

- Técnica de determinación cuantitativa de productos químicos, y preparación de soluciones.
- Técnica de muestreo.

DESARROLLO DE PROYECTOS:

En el Laboratorio, se implementaron sistemas de control de calidad de los diferentes productos: auxiliares y productos químicos. Entre otras cosas se detecto que el sulfato de sodio "nacional" era cloruro de sodio. En los análisis de los productos auxiliares se implemento como control el índice de refracción como característica peculiar de cada producto.

PROCESOS PRINCIPALES SEGUIDOS EN EL TRATAMIENTO DE LA TELA CRUDA:

- **GASEADO:** consiste en la eliminación de la pelusa pillin que trae consigo la tela; esto se lleva acabo por contacto directo , a alta velocidad de la tela con el fuego de la combustión de gas propano.
- **DESENGOMADO:** Llamase tela cruda a la tela tal cual como sale de los telares; esta tela trae consigo todas las impurezas que tiene el algodón , grasas, peptina, lignina, pigmentos naturales y tierra. Además de estas impurezas naturales trae consigo aceite de máquina y la goma, que viene a ser un refuerzo que se aplica al hilo para que pueda tejer sin roturas. En CREDISA se usa un alcohol polivinilico que es soluble en agua caliente.

El proceso de desengomado es a su vez un proceso de descrude porque no solamente elimina la goma sino también las impurezas del algodón. Se lleva acabo por el sistema de pad batch, se impregna la tela con un humectante-detergente a alta temperatura 98°C; esto reposa por cuatro horas y esta listo para ingresar al otro proceso que es el de preblanqueo.

- **PREBLANQUEO:** Se inicia con un lavado a 98°C se exprime y se impregna la tela con un baño que contiene: peróxido de hidrogeno, soda cáustica, estabilizador, antiespumante y un detergente. Este proceso se realiza en frío (máximo 40°C) y debe reposar por lo menos 24 horas luego de las cuales se lava a 98°C con un detergente. También se realiza por el sistema pad batch.

-**MERCERIZADO:** Es darle la propiedad de brillo a la tela por medio de un baño de soda cáustica (28°Be) por un tiempo de 50 a 120 segundos y a baja temperatura (18°C). Al llevarse acabo esta operación también se transmite al algodón las propiedades de mayor afinidad por los colorantes y mayor resistencia. Es necesaria que la tela este tensionada.

-**SECADO:** Se lleva acabo en una rama. Es importante el control de la temperatura y la velocidad de la tela.

-**TEÑIDO:** Es el proceso mas importante y se realiza por el sistema pad batch consiste en impregnar con baño de colorante a la tela preparada (preblanqueada) este baño a impregnarse debe ser una mezcla resiente de cuatro partes de colorante y una parte de carbonato de sodio al 20 %. Esta tela impregnada reposara de acuerdo a los tiempos de fijación que tienen los colorantes, esta tabla o curva lo da el fabricante, vía diskette o tabla. Luego se procede al lavado.

- **ACABADO:** Es el proceso mediante el cual se trasmite a la tela propiedades específicas para su uso, una tela para camisa tendrá un acabado diferente que una tela que se usará para tapicería, etc. Este proceso se lleva acabo en la rama.

3.- RESUMEN.

El Laboratorista, es el técnico cuya función es ejecutar los diferentes controles de todos los procesos incluyendo la toma de muestras y es el encargado de hacer los Controles de Calidad de las materias primas y los productos terminados. Reportando al jefe de Laboratorio quien con mayor criterio dará visto bueno o observará los reportes. En el laboratorio textil es una actividad principal el de matizar, es decir llegar al color que el cliente pide y simular en escala todo lo que realiza en planta

Existe normas y pasos para cada control; el asunto es comprender el porque de las cosas e implementar o mejorar todos los controles.

IV.-TENIDO DE ALGODÓN CON INDIGO

EMPRESA: **PERU DENIM S. A.**

DIRECCION: JR. CAJAMARQUILLA 1429
SAN JUAN DE LURIGANCHO.

CARGO : SUPERVISOR DE LA PLANTA DE TEÑIDO
Y ACABADO.

TIEMPO DE SERVICIO : TRES AÑOS Y OCHO MESES.
DEL 01/07/85 AL 03/03/89

INDICE

1.- INTRODUCCION.

PERU DENIM S. A. es una Empresa dedicada a la elaboración del muy conocido denim principalmente para los blue jean. Esta Empresa tiene cuatro plantas importantes:

- La Planta de Teñido : consta de un tren de teñido a la continua a todo lo ancho con INDIGO; este tren de teñido comprende la humectación adecuada del hilo, seguido de un exprimido para luego ser teñido por reducción con indigo posteriormente es expuesto por dos minutos al oxigeno del aire, este teñido se repite por cuatro veces hasta lograr el tono standard. Terminado el teñido se prosigue al lavado del índigo no fijado y secado, para luego ser engomado secado y recibidos en grandes carretes llamados portamateriales que va a ser la urdimbre de la tela en los telares en el cual la trama viene a ser un hilo crudo de esta manera se obtiene el clásico denim. Es importante notar que un proceso previo al teñido es el urdido del hilo.
- La Planta de acabado: viene a ser una secuencia de chamuscado, lavado, secado y sanforizado. En este proceso se aprovecha para enderezar la tela y evitar el torcido de las piernas del pantalón.
- La Planta de tejido; es la sección donde la urdimbre que es el hilo teñido con índigo se cruzara con un hilo crudo que normalmente se vera por reverso de la tela, se lleva acabo en una maquina llamada telar.
- La Planta de Hilandería: que viene a ser la transformación del algodón, que viene en pacas, a hilado. Todo esto viene a ser un complejo que esta descrito en los tratados de Plantas Hilanderas.

Como toda planta de proceso es necesario contar con fuentes de vapor, agua blanda y dura en abundancia, aire comprimido y corriente eléctrica, todo estos servicios viene a ser proporcionado por la Sección de Mantenimiento.

No solamente se obtiene el denim azul sino también el "denim negro" y de otros colores que viene a ser a diferencia del azul, teñidos con colorantes al azufre.

Todos estos procesos requieren de maquinaria exclusiva para este tipo de producción; y es admirable el avance de la tecnología en este sistema de producción.

2.- ACTIVIDAD PROFESIONAL

En PERU DENIM ocupe el cargo de SUPERVISOR DE TURNO de las plantas de Teñido y Acabado por un periodo de tres años y ocho meses desde el 01/07/85 al 03/03/89. Las funciones asignadas a este cargo son:

- Responsable de la Producción, supervisión de cada proceso, se reporta al Jefe de Tintorería.
- Hacer cumplir la secuencia de los procesos y solucionar los problemas que se puedan presentar al realizar estos.
- Responsable de la aprobación de lotes de producción.
- Distribución adecuada del personal.
- Reportar los datos de producción e informar las novedades del turno.

Interpretar las curvas de teñido y otros datos; orientando a los operarios.

- Dar las medidas correctivas adecuadas, en caso de ser necesario, asumiendo plena responsabilidad.

ORGANIGRAMA

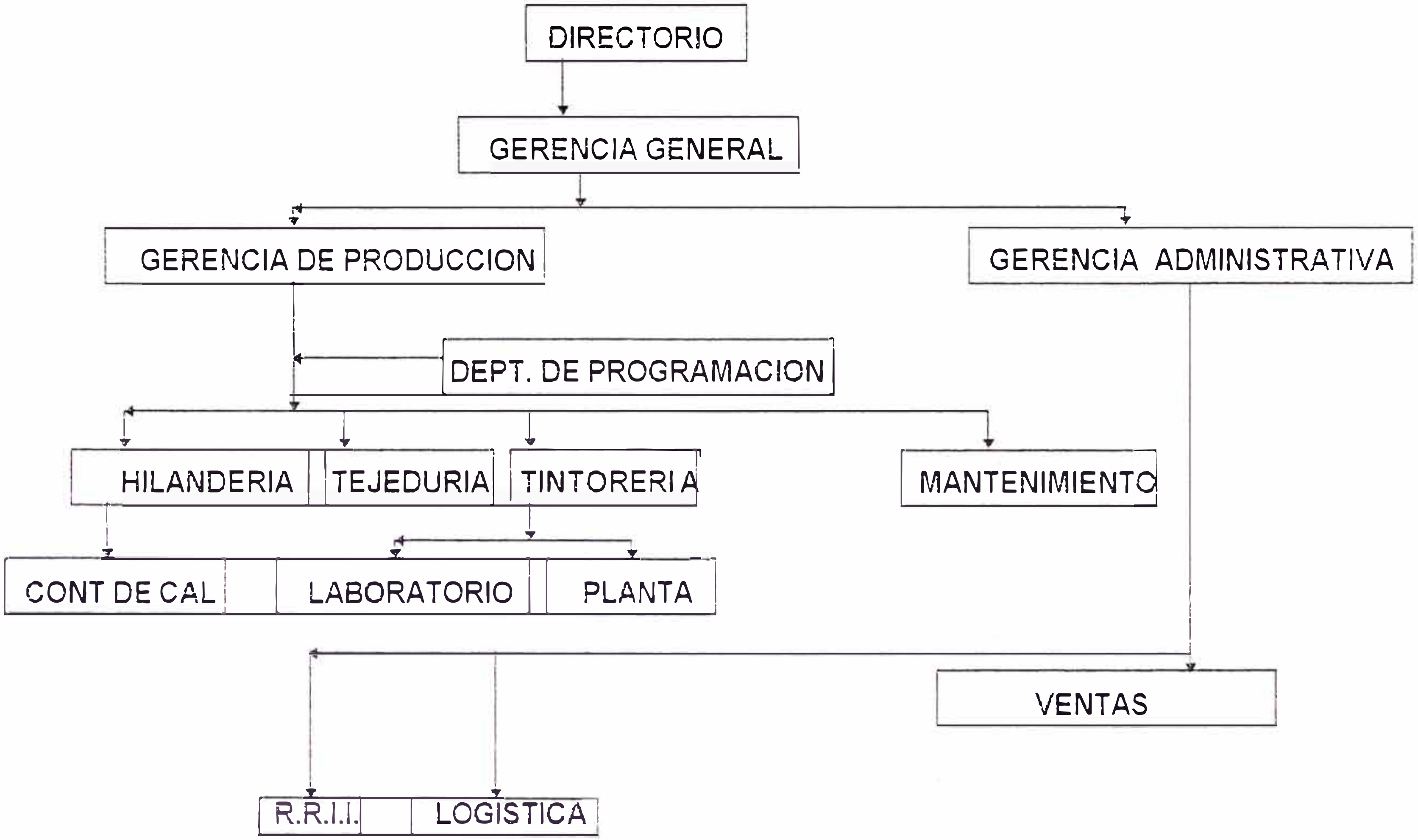


DIAGRAMA DE FLUJO GLOBAL

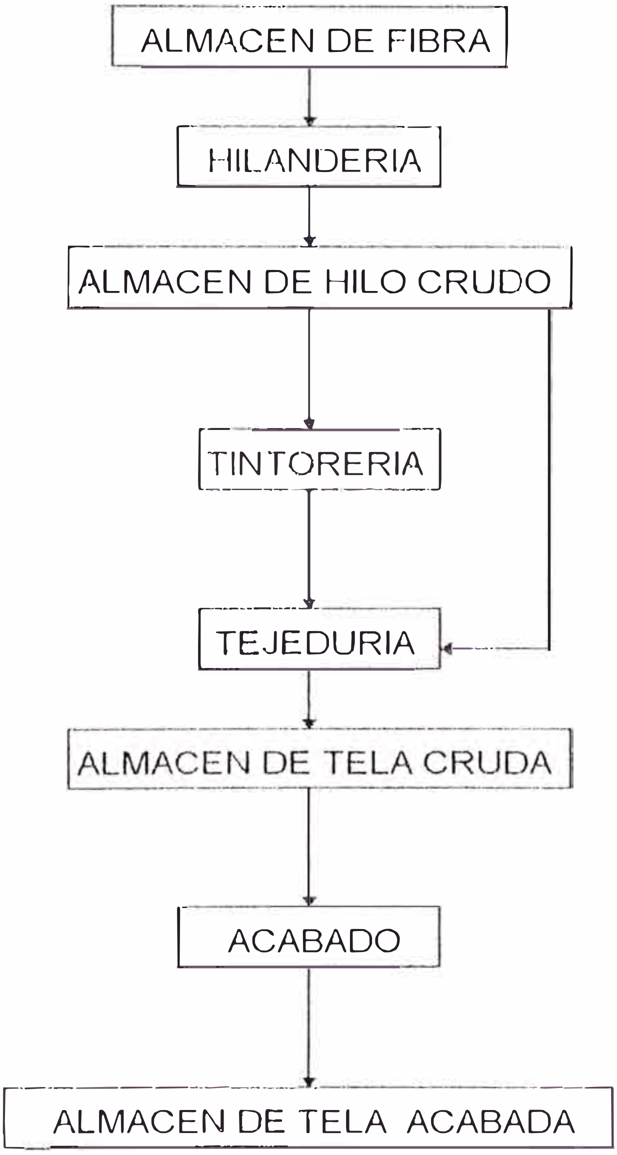


DIAGRAMA DE FLUJO EN LA TINTORERIA

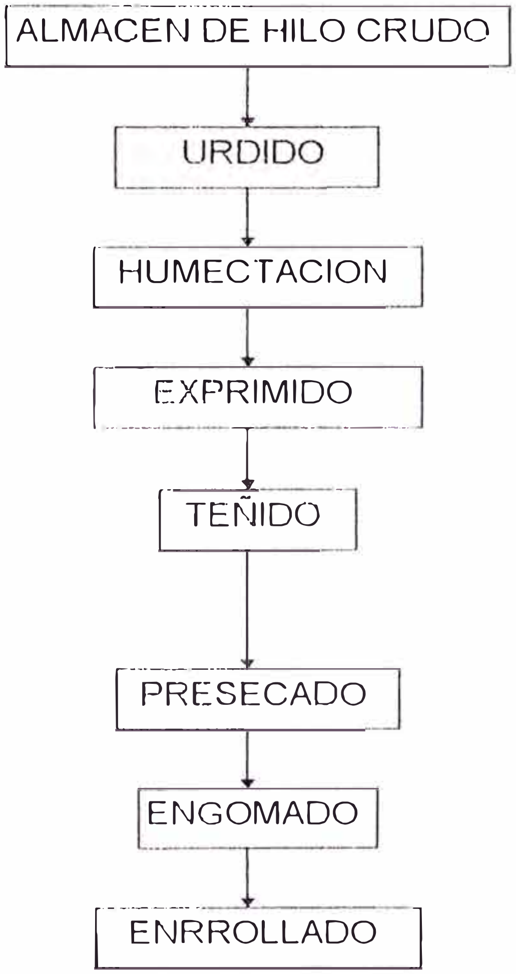
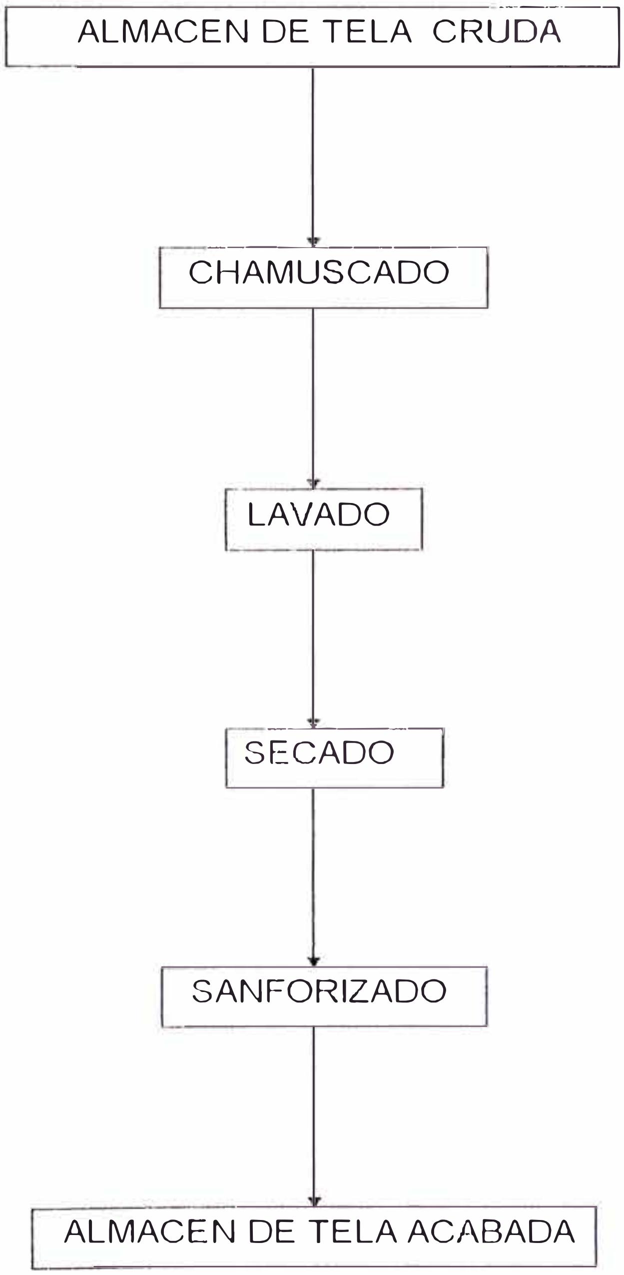


DIAGRAMA DE FLUJO : PLANTA DE ACABADO



TIPO DE TECNICAS DE INGENIERIA NECESARIOS PARA LA FUNCION DESEMPEÑADA:

- Técnicas de teñidos.
- Técnicas de determinación cuantitativa de productos químicos y preparación de soluciones.
- Técnicas de planeamiento de la producción.
- Estudios de tiempos y movimientos.
- Cubicación de recipientes.
- Técnica de instalación de conexiones y accesorios de tuberias.
- Técnica de operación de ablandadores de agua.
- Técnica de instalaciones eléctricas.

DESARROLLO DE PROYECTOS:

Uno de los proyectos que se tuvo que desarrollar fue la adecuación de todos los equipos y maquinarias, que fueron destinados al teñido de índigo, al teñido con colorantes al azufre. Para ello se tuvieron presente los siguientes cambios:

El teñido al azufre se lleva acabo a 98°C, con índigo se tiñe a temperatura ambiente.

- Los jabonados y enjuagues al azufre son a 98°C, con índigo a 60°C.
- Al azufre el reductor es el sulfuro de sodio y el medio alcalino esta dado por el carbonato de sodio. Al índigo el reductor es el hidrosulfito de sodio y el pH esta determinado por la soda cáustica
- Como el teñido se realiza a la continua, una partida puede tener de 15000 a 20000 metros; todos los cálculos tienen que realizarse de acuerdo a la velocidad de teñido que en promedio es de 20 metros por minuto bajando hasta 5 metros por minutos, en casos en que hubiese

problemas, la idea es que no tiene que parar el teñido pues ocasiona perdidas por veteaduras y manchado.

PROCESOS PRINCIPALES EN EL TEÑIDO CON INDIGO:

- PREPARACION O URDIDO: Es necesario tener en claro lo que es la URDIMBRE Y LA TRAMA en una tela plana. La Urdimbre viene a ser los hilos que van en sentido de todo lo largo de la tela, en el caso del Denim es la parte teñida. La Trama vienen a ser los hilos que cruzan a la Urdimbre perpenticularmente y van de extremo a extremo en lo ancho de la tela. En el caso del Denim son los hilos sin teñir es decir hilo crudo.

El Urdido viene a ser el proceso en el cual se van ha preparar rollos grandes llamados plegadores de 300 a 500 hilos paralelos de un largo total igual al metraje total de la partida, que normalmente puede ser de 15000 a 20000 metros, la urdimbre normalmente esta conformado por 3000 a 5000 hilos; esto se obtiene juntando diez plegadores en paralelo es se realiza justo al inicio del teñido. El Urdido se realiza en una maquina denominada URDIDORE: que consta de un castillo donde se acomodan las bobinas de hilado seguidos por unos guiadores que conducen uno a uno los hilos hasta llegar a un peine en donde a cada diente le corresponde un hilo luego sigue un tambor de velocidad constante donde ira apoyado el rollo grande de hilo llamado plegador.

- HUMECTACION: Preparado los plegadores estos se montan al tren de la maquina teñidora que tiene capacidad para doce plegadores. Se juntan diez plegadores conformando una manta de hilos. Esta manta recibe el primer tratamiento, el de Humectación que consiste en mojar lo suficiente el hilado de tal manera que el teñido no traspase el hilo sino deje un alma blanco, sin teñir, para esto se usa un humectante que puede ser Lepphen M de BASF o un producto similar. Se realiza a temperatura variable. La a0mentación del baño de humectación es constante y regulable.

- **EXPRIMIDO:** Este paso tan sencillo es muy importante porque regula el pick up de ingreso al teñido y debe ser constante se realiza en un foulard , que viene a ser dos rodillos de goma regulados por una presión neumática.

- **TEÑIDO:** Es lo mas importante de los procesos consiste en sumergir la manta en el baño de teñido y darle un arrastre de 75% a 80% de pick up , definido esto debe ser constante. Debe ser seguido de un proceso de oxidación con oxigeno del aire al cual estará expuesto por dos minutos. Esto se repetirá por cuatro veces seguidas es la única forma de garantizar una intensidad clásico blue denim.

Mantener el baño de teñido constante es una tarea de mucha responsabilidad y se lleva acabo con ayuda de un laboratorista, quien determinara la cantidad de hidrosulfito y de soda cada media hora y la reposición debe ser frecuencial; la adición de colorante y parte del hidrosulfito y de la soda se llevara acabo por el dosificador mecánico que tiene la máquina.

Oxidada la manta siguen dos enjuagues que normalmente son a 60°C con la ayuda de un detergente y neutralizando el pH que trae la manta.

-**PRESECADO:** Consiste en secar la manta que esta húmeda y teñida por medio de tambores de acero que giran y están calentados por vapor; la humedad final del presecado es de 9%.

-**ENGOMADO:** Consiste en recubrir el hilo teñido con una "goma" que normalmente puede ser un almidón o alcohol polivinilico, con la finalidad de darle mas resistencia al hilo al momento del tejido. la alimentación debe ser automática.

- **ENRROLLADO:** Es el proceso mediante el cual se recibe el hilado teñido y engomado en grandes rollos denominados plegadores de salida y pueden contener hasta 1400 metros de urdimbre; antes del enrollado los hilos son separados de acuerdo a los plegadores de ingreso por medio de varillas y nuevamente unidos y pasados por un peine; con la finalidad de evitar cruces y roturas a la hora del tejido. Estos plegadores encajan exactamente a los telares.

PROCESOS PRINCIPALES EN EL ACABADO DEL DENIM:

- **CHAMUSCADO:** Llamado también Gaseado es la eliminación de la pelusa o pillín, que tiene la tela, por medio de fuego que normalmente es proporcionado por combustión del gas propano.
- **LAVADO:** Se realiza inmediatamente después del chamuscado con la finalidad de apagar las "chispas" y lavar las cenizas y la goma.
- **SECADO:** La tela lavada debe ser secada, pero se debe tener cuidado en no secar demasiado la tela, muchos técnicos recomiendan dejar un 15% a 16% de humedad para luego ingresar al sanforizado. El secado se realiza en tambores de acero inoxidable giratorios.
- **SANFORIZADO:** Es la propiedad de no encogimiento que se le da a la tela, este proceso se realiza con ayuda de una banda de goma muy gruesa en la cual la tela se preencoge y luego se plancha en un tambor grande que usa un fieltro con esta finalidad.

3.-RESUMEN.

El Supervisor de Turno, es el técnico cuya función es la hacer cumplir el PROGRAMA DE PRODUCCION esto implica cumplir todos los procesos de producción bajo los parámetros establecidos y resolver los diferentes problemas que se puedan presentar a parte de los problemas técnicos los problemas de falta de personal.

PERU DENIM S.A. es una Empresa completa que inicia su producción con la fibra de algodón en pacas y su producto final viene a ser el denim que es una tela lista para ser usada en la confección. Para lograr este cometido el algodón pasa por cuatro plantas bien definidas:

- Planta de Heladería.
- Planta de Tintura.
- Planta de Tejeduría .
- Planta de Acabado.

El denim se a difundido en todo el mundo su demanda cada vez es mas creciente, el blue jean es una prenda que no pasará de moda.

V.-EMPRESA: QUIMICA DEL PACIFICO S. A.

DIRECCION: AV. VENTANILLA KM 8 - CALLAO -

CARGO : **LABORATORISTA** - EN EL DPTO. DE INVESTIGACION Y
CONTROL DE CALIDAD.

TIEMPO DE SERVICIO : DOS AÑOS Y DIEZ MESES
DEL 13/07/81 AL 22/05/84

INDICE

1.- INTRODUCCION.

QUIMICA DEL PACIFICO S.A. es una de las dos plantas de cloro-soda existentes en el país y viene trabajando desde 1963.

Todos los productos que ofrece QUIMICA DEL PACIFICO (QUIMPAC) se obtiene como derivados del cloro o soda lo cual provienen de la electrólisis del cloruro de sodio (sal común). El cloro y la soda vienen a ser insumos químicos básicos; así QUIMPAC produce:

- Soda Cáustica.
- Cloro.
- Acido Clorhídrico.
- Hipoclorito de Sodio.
- Cloruro Férrico.
- Sal refinada para consumo humano e industrial.

QUIMPAC es todo un complejo constituido principalmente por dos plantas la Planta Cloro Soda y la Planta de Refinería de Sal esta ultima planta no es nada compleja y lo que se realiza es un lavado, secado y molienda de la sal provenientes de las salinas de Huacho. La planta Cloro Soda si viene a ser todo un complejo donde se pueden apreciar las siguientes secciones adecuadamente coordinadas:

- Circuito de Salmuera:
    - Pozas de saturación.
    - Tratamiento y decantación de la salmuera.
    - Decloración.
- Sala de Celdas.
- Planta de cloro.
- Planta de Acido Clorhidrico.
- Planta de Hipoclorito de Sodio.
- Planta de Cloruro Férrico

- sistema de Agua de Enfriamiento, Torre Marley.

Además QUIMPAC cuenta con un Departamento de Investigación y Control de Calidad y un Departamento de Mantenimiento.

El Departamento de Investigación y Control de Calidad cuenta con un Laboratorio bien implementado donde se realizan pruebas de mejora de los procesos y un planificado control de calidad del proceso, de los insumos y productos terminados.

QUIMPAC se instala pensando en términos del Mercado de Soda Cáustica, criterio que se ha seguido rigiendo las sucesivas ampliaciones. El cloro, a la inversa de lo que ocurre en los países desarrollados, se relego a un segundo plano, pasando a convertirse en un molesto subproducto de estas plantas.

2.- ACTIVIDAD PROFESIONAL

En QUIMPAC ocupe el cargo de LABORATORISTA en el Departamento de Investigación y Control de Calidad por un periodo de dos años y diez meses, desde 13/07/81 al 22/05/84.

Las funciones asignadas a este cargo son:

- Control de Productos en Proceso:

- Análisis de sal en el saturador.
- Análisis de Calcio en la salmuera
- Análisis de Magnesio en la Salmuera.
- Análisis de Sal al ingreso a celdas.
- Análisis de cloro libre en la Salmuera.
- Toma de pH en varios puntos.
- Análisis de Cloro Activo en el proceso de elaboración de Hipoclorito de Sodio
- Análisis de Soda Cáustica libre en la elaboración de hipoclorito de Sodio.
- Análisis de Acido Clorhídrico en proceso.
- Análisis de Soda Cáustica en proceso.
- Análisis de Cloruro Férrico en Proceso.
- Análisis de Aguas.
- Análisis de yodo en la sal para consumo humano.

- Control de Productos terminados:

- Análisis de Soda Cáustica.
- Análisis de Acido Clorhídrico.
- Análisis de Hipoclorito de Sodio.
- Análisis de Cloruro Férrico.
- Análisis de Sal .

ORGANIGRAMA

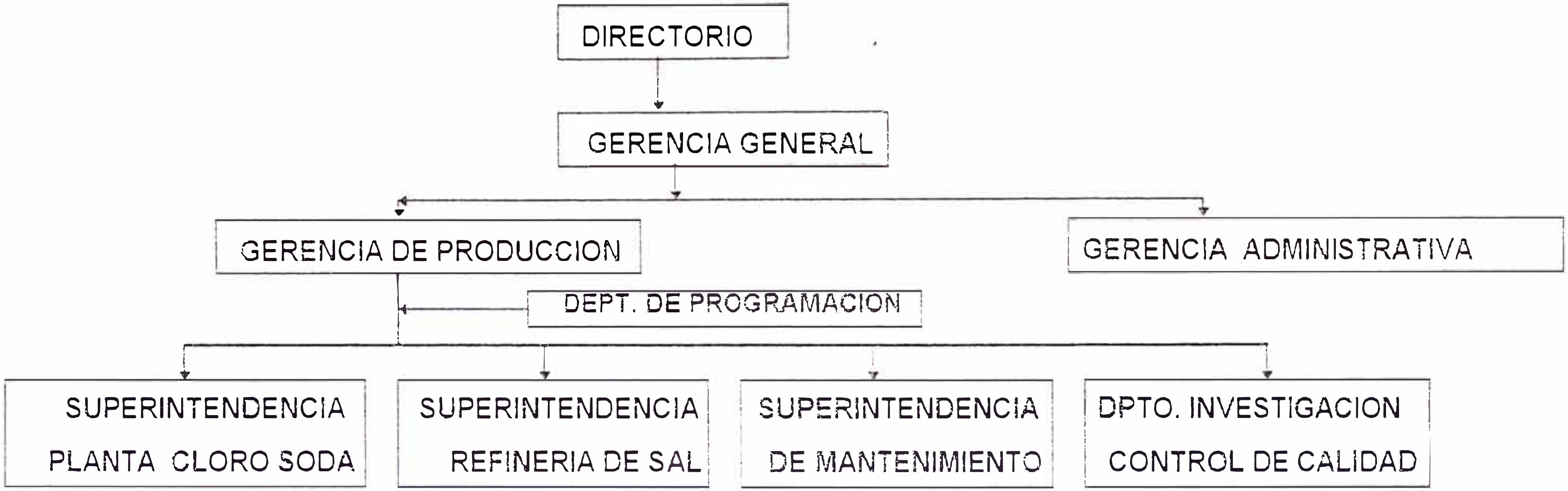
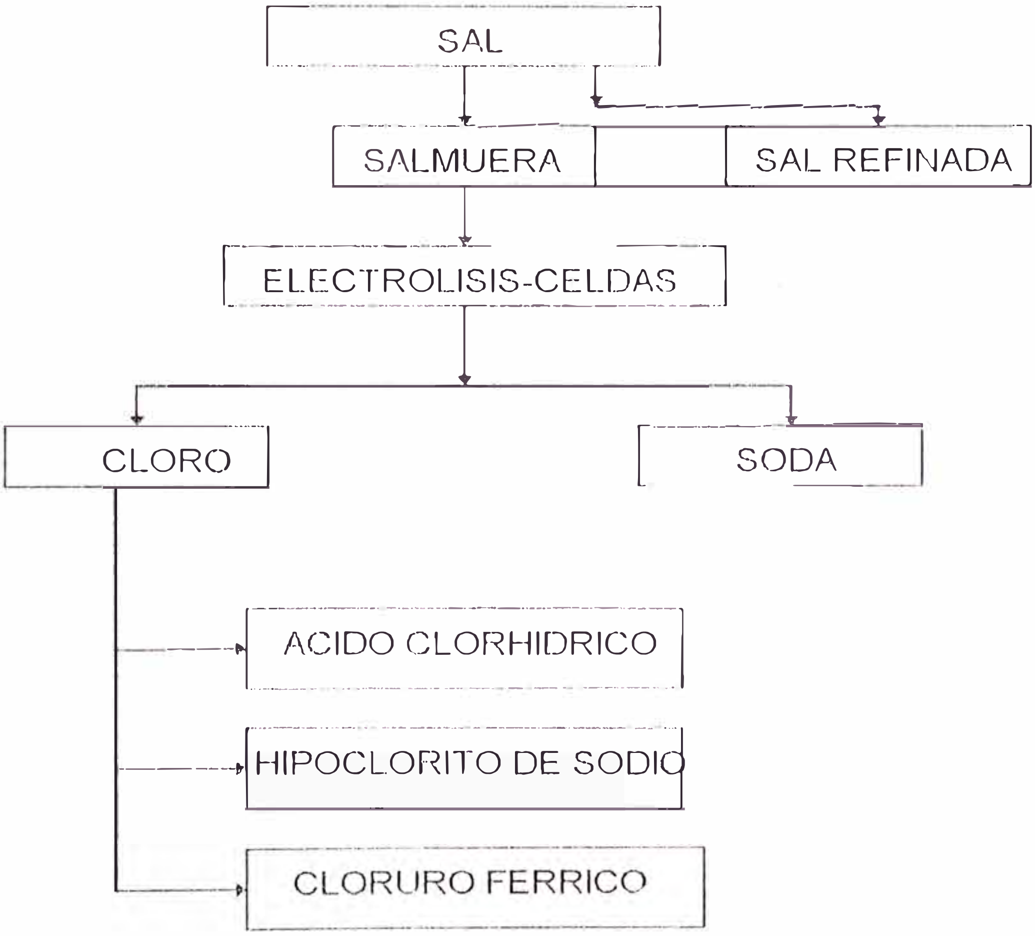


DIAGRAMA DE FLUJO GLOBAL



TIPO DE TECNICAS DE INGENIERIA NECESARIOS PARA LA FUNCION DESEMPEÑADA:

- Técnicas de determinación cuantitativa de productos químicos y preparación de soluciones.
- Técnica de muestreo.

DESARROLLO DE PROYECTOS:

- Obtención de Hipoclorito de Calcio de Alta Pureza, HTH.
- Obtención de Hipoclorito de Sodio con bajo contenido de soda cáustica.
- Optimización de Nuevos envases que conserven o prolonguen la vida del cloro activo de la lejía.

DETALLES SOBRE LOS PROYECTOS PLANTEADOS:

- HIPOCLORITO DE CALCIO DE ALTA PUREZA (HIGH-TEST HYPOCHLORITE): El Hipoclorito de Sodio en el mejor de los casos tiene 12% de cloro activo, mientras que el HTH que se comercializa en USA tiene 75% . Las pruebas de Laboratorio se basaron en la reacción del Hidróxido de Calcio con cloro gaseoso produciéndose hipoclorito de calcio mas cloruro de calcio y agua, esta reacción principal es exotérmica y va acompañada por reacciones secundarias perjudiciales a la formación del hipoclorito de calcio; es asi que una temperatura mayor a 40°C favorece la formación de cloruro de calcio y la disminución del pH hace que el hipoclorito de calcio se degrade a cloruro de calcio y agua. Otro problema que se debía resolver era el secado, se formaba una pasta muy higroscópica la cual no se podia calentar sino realizar un secado al vacio. En este proyecto se logro avanzar y se consiguió llegar hasta un 25% de cloro activo.

OBTENCION DE HIPOCLORITO CON BAJO CONTENIDO DE SODA CAUSTICO: este proyecto se realiza a raíz que todo el hipoclorito de sodio producido tiene de 1% a 1.2% de soda cáustica y esto hace que la lejia "queme" la mano del usuario; Este proyecto se baso en bajar el contenido de soda cáustica haciendo reaccionar el hipoclorito con un ácido débil asi se eligió el ácido carbónico, es necesario indicar que esta reacción es exotérmica y toda elevación de temperatura es perjudicial para el hipoclorito. Este proyecto técnicamente tuvo éxito lográndose bajar el contenido de la soda hasta un 0.4% .

- OPTIMIZACION DE NUEVOS ENVASES QUE CONSERVEN O PROLONGUEN LA VIDA DEL CLORO ACTIVO DE LA LEJIA:

En un muestreo realizado en los diferentes mercados expendedores de lejia, se concluyo que la lejia expuesta a los rayos solares y a la calor no conservaban el cloro activo que es el elemento beneficiario de este producto; en algunos casos se llego a verificar que de los 12% iniciales de cloro activo solo llegaba al 2%. Los nuevos envases se diseñaron atendiendo dos problemas principales : el envase deberia ser lo mas opaco y además que no absorbiera los rayos solares, se probaron varios materiales y se concluyo que debería ser de PVC con un color negro por dentro y un color comercial por fuera; es nuevo envase no solamente mejoro la conservación del cloro activo sino que resulto muy económico. No obstante de hacer las recomendaciones no se llego a usar estos envase debido a problemas de sellado de cojines.

DESCRIPCION DE LOS PROCESOS PRINCIPALES EN LA OBTENCION DE:

SODA CAUSTICA: Se obtiene por electrólisis de una solución de sal es decir una salmuera, debidamente tratada con mínimo contenido de calcio y magnesio así mismo con poco contenido de cloro libre disuelto; esta electrólisis se lleva acabo en una celda donde el cátodo es móvil, es de mercurio y donde el ánodo es de titanio; en el cátodo se forma la amalgama de sodio y en el ánodo burbujea el cloro la diferencia de voltaje a mantenerse es de 4.0 voltios. La amalgama de sodio pasara por un equipo llamado desamalgamador donde se hace ingresar agua desmineralizada y esta cargada negativamente el cual captará todo el sodio originando la soda cáustica . Esta soda normalmente es de 50%.

ACIDO CLORHIDRICO: Resulta de la combustión del hidrogeno con cloro en una atmósfera de cloro. Esto se lleva acabo en unos reactores donde el enfriamiento es permanente y se debe evitar la presencia de oxigeno para evitar explosiones que puedan traer destrucción en el reactor, los gases de la combustión se pasan por una torre de absorción en el cual en contra corriente se encuentra el agua desmineralizada, el control de la temperatura es importante. Este Acido Clorhidrico producido lleva consigo gran cantidad de cloro libre disuelto el cual le da esa coloración amarillenta . La concentración del Acido alcanza el 35%.

HIPOCLORITO DE SODIO: Si hacemos pasar por una torre de absorción, cloro y en sentido contrario una solución de soda cáustica (180 gr/lt) manteniendo una temperatura menor a 40 °C logramos obtener hipoclorito de sodio mas cloruro de sodio y agua, existen reacciones secundarias que es necesario controlar para evitar la degradación del hipoclorito a salmuera.

CLORURO FERRICO: Se obtiene en un reactor agitado haciendo reaccionar oxido férrico con ácido clorhídrico inicialmente seguido por la adición de cloro, este producto es altamente corrosivo.

3.- RESUMEN.

QUIMICA DEL PACIFICO S.A. viene a ser un complejo industrial constituido por varias plantas:

- Circuito de Salmuera.
- Sala de Celdas.
- Planta de Cloro.
- Planta de Acido Clorhidrico
- Planta de Hipoclorito de Sodio.
- Planta de Cloruro Férrico.
- Sistema de agua de enfriamiento.
- Refineria de sal.

Conocer detalladamente, cada una de ellas no seria práctico existen profesionales especializados en cada una de ellas, y es a ellos a quien se recurre en caso de problemas severos, La Superintendencia de Producción y los Supervisores de turno con apoyo de los controles rutinarios realizados en el Laboratorio resguardan que los procesos se lleven acabo dentro de los parámetros establecidos, en caso de salirse de estos parámetros no solamente existe el riesgo de perjudicar la producción sino de causar accidentes y destrucción, por lo tanto el personal es consiente de estos riesgos y cualquier anomalía es comunicada al jefe superior quien tomara decisiones e incluso se vera forzado a parar planta . Arrancar una planta cloro soda, por la complejidad toma su tiempo llegándose a sobrepasar las 24 horas en algunos casos, para llegar a plena carga. La producción es continua las 24 horas del dia llegándose a trabajar domingos y feriados; los mantenimientos son anuales en cuyo caso si se para planta, no obstante las reparaciones es trabajo de todos los días, apesar que existe equipos instalados en paralelo (stand by) para cualquier eventualidad.

Por existir emanaciones de residuos tóxicos esta planta esta situada en lugares alejados de la población y también por existir riesgo de desastre.